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Metals Review

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MACHINING OF METALS ISSUE

Featuring

Machining and Machinability

By Francis W. Boulger
Assistant Supervisor
Battelle Memorial Institute

Important developments in machining practices, and progress in machinability tests and theories reflected by recent technical literature.

Machine Tools and Tool Materials

New toolsteels and carbides, tools and machines developed during the past 12 months that are of particular interest to the metallurgist—as described by the equipment manufacturers.

NOTABLE LECTURES

Reported This Month

Cohen explains tempering of toolsteels in Sauveur Lecture at Boston . . . Sands says that structure is more important than composition in its influence on machinability . . . Crump reviews use of cemented carbides for nonmachining uses . . . McQuaid takes metallurgists to task in sermon on effect of stresses on machine design . . . Cory tells about design of forming dies . . . Wilhelm exhibits samples of metallic thorium and uranium in talk on atomic energy . . . Nelson tells how hydrogenated castor oil is used as a new lubricant for drawing stainless steel . . . Johnson shows how raw material control is a money-saver in the blast furnace.

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Metals Review

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March 1947

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Machining and Machinability

Developments in Practices, Tests and Theories Reflected by Recent Technical Literature

By Francis W. Boulger
Assistant Supervisor, Battelle Memorial Institute

RECENT improvements in machining practice have followed the paths marked in this field for the past 15 years. In almost every phase of metal cutting, developments aimed at better surface finish, greater precision, and faster production have been recorded. The impetus has come from the desire of manufacturers to improve their operations, and this often leads to the application of methods that seem unconventional to the uninitiated.

Specification of surface finish is becoming more common, and Rose (20-329, 1945 volume)* has pointed out the typical requirements for various applications. Use of ground, honed, lapped, buffed, or polished surfaces is becoming necessary on an increasing number of highly stressed, rotating, or sliding parts. Even for high-quality finishes, there are now several different production methods which give substantially equivalent results. The choice between them depends on the equipment available, quantity of parts involved, and skill of the operators.

Machines

The present trend seems to be to rely on equipment rather than on skilled operators for precision results. Transferring control of routine repetitive operations to cam, hydraulic, or electrical mechanisms is usually more efficient and satisfactory. Himmelright (20-269, 1945 volume) and Graves (20-358, Sept. 1946) call attention to the economics made possible by equipping available machines with simple jigs and fixtures.

Refinements and developments in cutting tools have inspired design changes in machines. New lathes and turret lathes, operating at higher speeds and up to three times the power of those made before 1940, are being built with stronger saddles, rests, and tailstocks (20-436, Nov. 1946). Turret lathes in particular are being equipped with radically different toolholders in order to reduce vibration and thus lengthen tool life. Such improvements are necessary in machine tools because close limits on dimensions and surface quality are here to stay and are becoming increasingly common.

*Literature references are designated by the corresponding section and item numbers in the "Review of Current Metal Literature" rather than by repeating the entire title, author, and source. Articles appearing in 1946 were listed in *Metals Review* for the month indicated; the others are given in Volume II, 1945, assembled from listings of that year.

Tools

Removal of large quantities of metal as rapidly as possible has necessitated increased attention to tools. Cemented carbide tools are receiving most study because they offer the best possibility of increasing the rate of machining. The carbide tools, being very hard and wear resistant, are recommended for finishing cuts on steel. They are also being used quite widely for machining aluminum and other materials. Application of carbide-tipped tools sometimes requires special precautions because of the brittleness associated with their high hardness. Lucht (20-10, 1945 volume) points out that the so-called triple carbides (tungsten-tantalum-titanium) are somewhat tougher than the straight tungsten carbides, and recommends them for roughing cuts. Use of flywheels on milling machines to reduce vibration and maintain constant speeds is another device for improving the effective toughness of carbides during machining.

Francis W. Boulger, assistant supervisor of research in steel processing, has been associated with Battelle research on the machinability of lead-bearing steels, high-sulphur free-cutting steels, and shell forgings. He has also conducted research on cast steels, nonmetallic inclusions, and cold drawn steels, and is co-author of several scientific papers that have been published by the American Society for Testing Materials and the American Foundrymen's Association. Mr. Boulger holds a Metallurgical Engineer's degree from the University of Minnesota and a Master of Science degree from Ohio State University. He has been a member of the Battelle staff since 1937.

Various methods of mounting carbide tips on tool shanks have been tried in efforts to prevent chipping. Lucht (20-320, Aug. 1946) counsels that brazing is preferable to clamping as a method of tip mounting. It seems generally true that assembly by brazing is more dependable and gives a longer and more uniform tool life. Many writers have described the successful use of copper cushions to increase the tool life of carbide-tipped tools. A copper sheet, about 25 gage, is placed between the carbide insert and the tool shank in an effort to reduce undesirable vibrations. More uniformly loaded tools (by such expedients as careful mounting) pay dividends in longer tool life by permitting the use of harder grades of carbides.

Although little has been reported, considerable effort has been devoted to improving carbon steel and high speed steel lathe tools by hard chromium plating. Presumably, the chromium plate might result in lower friction between the chip and tool, thereby improving tool life and surface finish on the work.

One manufacturer has done considerable development work on carbide files (20-570, 1945 volume). Flat files, band files, and disk files assembled from carbide inserts are described as competitive with steel files and abrasive wheels in some applications in spite of their high initial cost.

Negative-Rake Tools

An important development in carbide tooling is the introduction of negative-rake cutting angles. Although this practice seems radical at first, reflection shows that it bears a resemblance to the principles of grinding. As in grinding, high spots on the work meet the cutter back of the extreme edge, and efficiencies are better at high speeds. The widest application of negative-rake tools has been in milling, but the success in this field has led to their employment in other machining operations. Jalma (20-19, 1945 volume) and others describe the use of negative-rake tools in turning, boring, and planing operations.

The load required for cutting with positive-rake tools increases with increasing speed. According to Ernst and others (20-167, 1944 volume; 20-23, Feb. 1946), the force required for milling with negative-rake tools *decreases* at higher speeds (above 1000 ft. per min.). This is believed to result from a greater drop in shear strength of the work at the higher temperature accompanying the more severe chip deformation characteristic of negative-rake tools. Furthermore, Armitage and Schmidt (20-378, 1945 volume) show that the wear of positive-rake cutters at high speeds soon increases the power consumption above that of negative-rake milling cutters. Thus the less effective cutting action of negative-rake tools is overcome at high speeds and is combined with the obvious advantage of the stronger tool shape. Harder carbides can be used with negative-rake cutters but the shape is particularly recommended where tools fail by chipping rather than by wear. The advantages of negative-rake angles in extending tool life and increasing production are more noticeable at high speeds and heavy feeds.

Armitage and Schmidt's experiments (20-378, 1945 volume) also indicate that milling cutters with positive radial-rake angles and a negative-rake angle at the cutting edge offer some advantages. Their compromise improved efficiency for some conditions by using a negative rake extending from the cutter tip for a distance of about twice the maximum feed per tooth.

Ideally, negative-rake tools require machines that are more rugged, higher powered, and capable of operating at faster speeds than normal. Therefore, the promiscuous use of negative-rake tools is not recommended for older machines. Depending upon the tool shape and cutting conditions, negative-rake tools may have 20% higher power requirements. At some comparatively high speed, the specific power required per unit of stock removed may be lower, but since the rate of metal removal is higher than normal, the large power input is still necessary. In general, speed and depth of cut with negative-rake milling cutters should be as great as possible within the limitations imposed by the power of the machine. Light cuts contribute to excessive abrasive wear for the same metal removal, although, of course, they give better finishes.

Shaving, Hobbing, Honing

Based on wartime experience with aircraft engine gears, many gears that were formerly ground are now being finished by shaving (20-131, 1945 volume). Shaving is also used in the production of cluster gears and other parts that are difficult to grind. A variation of the process, in which both cutters and work rotate, is used, according to Praeg (20-14, Feb. 1946), for finishing operations on all kinds of cylindrical, flanged, and conical parts. The cutters used are similar to fine-pitch milling cutters and can remove 0.01 to 0.02 in. of stock from rough machined parts and do so to grinding tolerances.

Sheffield (20-172, 1945 volume) has described a series of tests with carbide tools on large marine gears. The standard hobbing machine was modified by several changes including a flywheel and composite hob with cemented-carbide strip teeth. Operation at speeds up to 300 ft. per min. resulted in large savings in time. Carbide hobs also permitted the use of harder gear blocks.

The field for honing seems to have broadened considerably because of better honing materials and the use of three- or four-spindle machines equipped with rotating index fixtures. Martz and Peden (20-113, April 1946) mention applications in production involving the removal of 0.008 to 0.035 in. of stock. This calls attention to the fact that with newer practices, it appears possible to remove much more stock than formerly and at faster over-all rates. The process is competing with grinding in some applications and can be adapted to give a variety of surface finishes.

Crush-Dressing

The practice of contouring grinding wheels by crush-dressing, for mass production of ground screw threads and formed parts, is gaining popularity. The crushing tool is a roll with annular grooves corresponding to the surface to be ground—a negative of the shape to be impressed on the grinding wheel. The crushing roll and the grinding wheel are rotated in contact under suitable pressure until the desired contour is produced in the wheel. The apparent incongruity of using steel to form an abrasive wheel to be used to shape steel disappears when it is realized that the effective cutting capacity of a grinding wheel depends principally upon its *speed.* The rotating speeds of 150 to 300 surface ft. per min. used in crush-dressing are only a fraction of those used in grinding.

Although almost any steel can be used successfully, Linxweiler and Moss (20-376, Oct. 1946) recommend standard high speed steel or high-carbon, high-chromium for crusher rolls. Vitrified rather than plastic-bonded grinding wheels are preferred because they are less resilient. Alumina grinding wheels are ordinarily used, but limited experience suggests that silicon carbide grits may offer some advantages, particularly for grinding hard materials. Crushing is usually done dry.

Crush-dressing is said to be an economical process for preparing form grinders because of its rapidity and the low cost of the crusher tool in terms of production. Several users report that crush-dressed abrasive wheels give improved quality and larger quantities of parts per dressing compared to diamond-dressed wheels. The faster metal removal and cooler operation reported are attributed to their rougher surface. Since crushing is a severe operation for wheels, their useful life appears to be an inverse function of the time required for dressing. Most cylindrical grinders can be converted for crush-dressing but some new thread-grinding machines are being built with integral crush-dressing attachments.

Improved grinding wheels, coolants, and methods of dressing the abrasive wheels are responsible for marked advances in thread grinding. This process was originally employed only on hard parts such as gages and taps or when extreme accuracy with a good surface and high finish was required. According to Grimm (20-206, 1945 volume), it is now being used in production operations for lead or adjusting screws, alloy steel studs, and for hardened setscrews. The process is applicable to almost all forms of straight and taper threads. Sometimes threads are produced by other methods before heat treatment, and finished by grinding, but usually threads are ground on cylindrical blanks. Cost comparisons with other methods are often sufficiently favorable to justify thread grinding on soft steel parts.

A high degree of accuracy, within 0.0001 in. per in. in lead tolerance, is obtainable on a production basis. Vitrified alumina abrasive wheels seem to be preferred when extreme precision is required, but resin-bonded wheels, which are less rigid, hold their shapes better. Diamonds, set in hard rubber or plastic wheels, are used for thread grinding of carbide taps. Single-edged wheels, having the form of the single thread to be ground, are the most accurate. Wheels with several ribs are used for rapid production on large lots when slight inaccuracies are permissible.

Centerless grinding of plain cylindrical surfaces was once considered revolutionary; hence, recent application of the centerless method to thread grinding (20-115, 1945 volume) should be listed as an important advancement. Centerless grinding principles have been applied in producing screw threads on hardened steel blanks at high rates of production. Half-inch screws, ¼ in. in diameter, can be threaded at the rate of 85 per min. (20-107, 1945 volume). Socket setscrews with 11 to 40 threads per in. have been produced by this method for about two years. Lead errors of less than 0.0005 in. per in. are obtained with fairly long life for the abrasive wheels. Thread diameters up to 12 in. have been successfully handled in other applications.

Abrasive-Belt Grinding

Increasing use is being made of abrasive-belt grinding for surface and edge preparation of machined or formed parts. Modern belt grinders use alumina or silicon carbide grits bonded to cloth or paper belts with strong, water resistant, plastic adhesives. Sprays of water, soluble oil or palm oil are used for cooling and for washing chips from the belt. Many applications are really machining operations since they remove approximately 1/32 in. of stock from flat or curved surfaces (20-107, April 1946). The areas ground at one time are usually less than 16 sq. in. Much larger areas have been ground on a

production basis by using special tables to feed the stock beneath the working area of the belt or by using contact roll-type grinders. Special machines permit the method to be adapted successfully to fine grinding sheet and strip—especially stainless steel—coarse grinding billets, plates, and internal grinding and polishing (20-325, Sept. 1946).

Simple fixtures and hard platens are used when accuracies of 0.0005 in. are required, and hand operations when tolerances are larger (20-274, Aug. 1946). Resilient platens are used in belt-grinding convex, concave, and other curved surfaces. Jigs and automatic feeds and stops are employed on production items. Although speeds may be as high as 2500 to 4500 ft. per min., copious amounts of coolant dissipate the heat, reduce warpage and discoloration of the work, and avoid dust.

High Speed Band Sawing

Another advancement of a specialized nature is the use of extremely high speeds in cutting metals with band saws. The difference between conventional and high speed sawing is that the ordinary saw cuts chips at approximately room temperature while unlubricated saw blades traveling at high speed develop enough heat to soften the workpiece. Hancock (20-324, 1945 volume) claims that the surface of the work becomes semimolten. His experiments indicated that the high speed saws cut stock 1/3 to 2/3 faster for a constant thrust and require less thrust than conventional saws for equal lineal feeds. Woodworking band saws were used in the early experiments, but metal saws with sufficiently high speeds are now available commercially (20-198, June 1946).

Velocities are generally of 3000 to 15,000 surface ft. per min. Although no coolant is used, the blade remains cool because each tooth remains in contact with the work for a very short time. Since the cutting depends principally upon friction, initial tooth hardness is of little importance and worn blades usually give better results than freshly sharpened ones. Failure ordinarily occurs by breakage, so softer blades often give longer life.

Although widest application of the method has been for sawing sheet metal, it is also applicable to heavier sections by proper selection of conditions and use of mechanical feeds to provide sufficient pressure (20-198, June 1946). Velocities are increased for cutting thick materials and alloy steels in order to impart sufficient heat to the work to induce the desired softening. Chamberland (20-77, March 1946) recommends blades with 10 to 18 teeth per in. for cutting steel and cast iron but coarser pitched blades for light metals.

High speed sawing of light metals does not take place by fusion cutting. The saw removes material by the conventional method, but new coarse-tooth designs increase the efficiency and strength of the blades. Speeds of 2500 ft. per min. are used in band sawing aluminum and magnesium. High velocities are also recommended for better efficiency in band sawing plastics, copper, brass, and zinc alloys.

Machinability

From a metallurgical standpoint, machinability is probably best defined as a complex property of a material which controls the facility with which it may be cut to the size, shape, and surface finish required commercially. Attempts to measure machinability are usually based on determinations of tool wear, chip behavior, rate of metal removal, or energy consumption. Despite the undoubted importance of surface finish, few investigators have made it the primary basis for rating materials. This may be a serious oversight because surface finish often controls the practice followed and the production obtained commercially.

The problems in measuring machinability are very complicated. Because of the numerous variables involved, experimental conditions must be simplified by many assumptions or by utilizing observations of shop operations under comparatively uncontrolled conditions. The former seems to be preferred.

There are many types of machinability tests because inductive reasoning leads people to make different assumptions and assign different degrees of importance to various factors. Since investigators generally realize the dangers inherent in assumptions, in laboratory tests the machining operation, cutting fluids (if any), tool shapes, and tool materials are selected arbitrarily and held constant. The materials under study are then evaluated by measuring some other important variable believed to bear a close relationship to cutting quality. The quantity of metal removed for a constant feed load or tool life, or the pressures, wear or life of the tools under known conditions, are often used as criteria for machinability. Measurements of tool and work temperatures or the amount of heat generated during cutting operations (20-194, 1945 volume; 20-55, March 1946) are also used as bases for comparisons.

Because of the diverse assumptions and types of tests, the results of machinability tests are often contradictory. Even if each answered a particular question, it is not yet possible to summarize them in a comprehensive philosophy of metal cutting. In a general way, low strength and low ductility during cutting seem to be desirable for good machinability. Since these properties are mutually contradictory for many materials that are machined, the desired balance between them would be expected to vary for different testing or machining operations.

Improvements in machinability of metals can be of considerable economic value. Frequently, the savings in machining costs are sufficient to overcome higher material cost. Even if the savings from fabricating costs do not cut the cost per piece, the increased capacity may lower the total cost by reducing fixed charges (20-315, Aug. 1946). The benefits are most noticeable in repetitive or automatic operations. Consistent quality of raw material is especially important because the machines must be set to operate satisfactorily on the low side of the expected range of cutting quality; little advantage is gained from better machinability of material on the high side of the range.

Additions of lead to steel improve its machining characteristics strikingly (3-35 and 20-286, 1945 volume), as was demonstrated by Inland Steel Co. nearly 10 years ago. Such steels have been used to a considerable extent in Great Britain in wartime, and comments which have come to hand have been unanimously favorable. Marked increases in tool life and production have been obtained in comparison with results on several grades of nonleaded steels. Although this method of improving machinability originated in this country, very little lead-bearing steel is being produced in the United States. The disappearance of the product from the market is partly attributable to production difficulties, although large tonnages were produced for export during the war. In other words, it is not a particularly attractive item to the producers.

Increasing the sulphur content of a steel, regardless of the method of addition, improves its machinability. Robbins (4-32, May 1946), Clarke (20-581, 1945 volume), and others claim, on the basis of shop observations, that adding sulphur as sodium bisulphite confers special benefits. Unfortunately, few of the articles give comparisons between steels which are identical except for the mode of sulphur addition. Too often the data seem inconclusive because of other differences in composition, strength, microstructure, and processing history.

Harvey (3-33, 1945 volume) gives tool life test results by O. W. Boston indicating that boron additions slightly impaired the machinability of a resulphurized, medium-carbon steel. The boron-treated steel received the same heat treatment and developed the same hardness as the regular steel used for comparison but had a finer grain size. The latter difference may have been an important one but the results seem reasonable, whatever the cause.

The inherent ductility and high capacity for workhardening of austenitic steels tend to produce continuous chips during machining. As in carbon and low-alloy steels, additions of sulphur, selenium, tellurium, lead, and bismuth improve the machinability. Sykes (20-295, Aug. 1946) points out that the effects are noticeable in turning operations but most pronounced during drilling and sawing. Therefore, he and Woolman (20-230, July 1946) conclude that the difficulties of machining austenitic steels are largely associated with conditions of chip formation and disposal rather than entirely with their workhardening characteristics.

Crampton (20-134, 1945 volume) re-

ports results from laboratory tests on copper alloys that agree with commercial performance. He rates the solid solution or single-phase alloys, which are ductile and produce continuous chips, as the least machinable of copper alloys. Alloys consisting of two phases have better machinability. When they contain small quantities of certain elements, both classes exhibit better machinability and produce small, brittle chips in cutting operations. Lead has been used for many years to improve the cutting quality of copper alloys but sulphur, selenium, tellurium, and bismuth have been tried recently and found to offer possibilities.

Commercially pure aluminum is considered difficult to machine because of the troubles encountered in producing a good surface finish. From this standpoint, machinability is improved by silicon, copper, magnesium, nickel, or manganese, which are added to improve casting qualities or other properties (3-181, 1945 volume). In common aluminum alloys, the chip characteristics and surface finish are usually improved by additions of 0.5% antimony or lead or 0.2% tin, as pointed out by Murphy (20-296, Aug. 1946). Cadmium probably has a similar effect but, like tin, has a deleterious effect on hot working characteristics. In general, surface finish is the main machinability requirement for aluminum alloys; power requirements are low and tool life good.

It has become obvious from laboratory and commercial tests that machinability ratings based on a particular machining operation, such as turning, may not hold quantitatively for other operations. In fact, the relative machining quality of two materials may be reversed. The obvious differences in feeds, speeds, and tool pressures may account for this behavior. As Booth suggests (20-301, Aug. 1946), the anomalies may be partly attributable to the fact that two functions are involved in machining—cutting chips from the workpiece and disposing of them before they interfere with the operation. Superior machinability with internal tools such as taps, drills, and saws may depend to a larger extent on the shape of the chips and facility of their removal.

This may explain why the optimum structure differs for different machining operations, as pointed out by Robbins (4-31 and 4-32, May 1946) and Sykes (20-295, Aug. 1946), and Witteman (20-413, 1945 volume). From observations on commercial machining of medium-carbon steels, Witteman concludes that spheroidized structures are better in turning and poorer in drilling operations than lamellar structures. For production involving several operations he suggests that a compromise must be made or double heat treatments be invoked to achieve maximum efficiency.

Metal Cutting Theory

M. E. Merchant's work on the mechanics of metal cutting (20-190, 20-262, 20-534, 1945 volume) is probably the outstanding recent contribution to machinability theory and testing. His series of publications describes a method of analyzing the chip geometry and force system for specific cutting operations which evaluates materials or other testing variables in terms of basic mechanical quantities. The theory and experiments described have been confined to lathe operations but may be extended under certain conditions to milling, turning, planing, and shaping operations with straight-edged tools. The analysis has been restricted to conditions under which a continuous chip, without a built-up edge adjacent to the tool, is formed. Merchant says, however, that the theory gives reasonable agreement with experiment when a built-up edge is present provided it is small, and that discrepancies are not too large when segmented chips are formed. Because of the great interest aroused by Merchant's papers, it seems desirable to indicate in a very general manner his theory and experimental method.

Merchant's principal assumption is that the total work of cutting is the sum of that required in shearing the chip from the workpiece and that used in overcoming friction between chip and tool. It is also assumed that the chip shears on the plane of maximum shear stress and that the plane is oriented so the total work of cutting is at a minimum. The direction of the shear plane is also considered to be affected by the normal compressive stress on potential shear planes ahead of the cutting edge. This correction factor is based on Bridgman's work showing that the shear strength of a material is affected by the normal stress acting on the shear plane.

Merchant's work indicates that, for certain types of cutting, the behavior of a metal during machining is affected principally by three properties, namely:

1. Shear strength of the metal during cutting.
2. Coefficient of friction between chip and tool as measured by a friction angle *T*.
3. Rate of change of shear strength of material with applied compressive stress normal to the shear plane. This property is measured by an angle *C*, which is considered a constant for the metal.

For the restrictions on machining methods and chip formation outlined, relationships between the three properties of the metal and the cutting process are quite simple. The chip forms by plastic deformation, and shears on a plane extending from the cutting edge to the surface. The shear plane makes an angle ϕ with the line of tool travel. This shear angle varies for different materials and thus changes the length of the shear path. Naturally, therefore, the resistance offered to cutting depends on the shear angle as well as the shear strength of the metal.

Merchant reports that the shear angle is controlled by the friction angle and the constant *C* according to the formula:

$C = 2\phi - T +$ rake angle of the tool.

The shear strength during cutting, the constant *C*, the friction angle, and the tool-rake angle control the forces and chip formation during cutting. The first two quantities need not be determined by cutting tests, but they usually are because the chip geometry must be known in order to determine the friction angle. Therefore, a cutting test seems to be the simplest method of determining the various quantities necessary to compare different materials.

Merchant employs a tubular workpiece and feeds a carbide tool parallel to the axis, removing a continuous chip from the end surface. The tool forces in two directions (cutting force, thrust force) are measured with a dynamometer during the test, and the ratio between feed and chip thickness is calculated. From these data and from the feed, chip width, density of material, cutting velocity, and tool-rake angle, various quantities characteristic of the material and cutting operation can be calculated. Values for friction coefficients, shear strain and strength during cutting, and the work required in shearing and in overcoming friction can be calculated according to the theory. Such calculations are very simply made by alignment charts (20-490, Dec. 1946).

The theoretical analysis of metal cutting given by Merchant and Ernst is intriguing and represents an advancement over those suggested in the past. It remains to be seen, however, whether or not it permits reliable evaluations of machinability. It may be that the approximation resulting from various assumptions and restrictions is not good enough to distinguish between similar materials. Reports of tests on different kinds of steel, including resulphurized grades, would enable others to judge the value of the procedures. Tool pressure measurements by themselves have not provided much valuable information, so it is important to learn to what extent determinations of chip geometry and the theory extend their usefulness.

Merchant has given comparatively few data permitting evaluations of the sensitivity and reproducibility of his methods. In tests on a particular N.E. 9445 steel, the values reported for the "constant" *C* varied from 70.5 to 84.3°. The steel was tested under 15 combinations of speed, feed, and tool angle, and the values are presumably the averages for five tests for each condition. The spread in values for *C* indicates that the neglected variables of plastic strain, temperature, and rate of shear *do* affect the plasticity conditions. In general, the results on the N.E. 9445 steel indicate that increases in cutting speed, feed, and rake angle increase the shear angle for otherwise similar conditions. The larger shear angles were accompanied by lower cutting forces and lower total work requirements.

Arnold and Hankins (20-293, Aug. 1946) also point out the importance of shear strength and friction between chip and tool in determining the behavior of a material in cutting opera-

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MACHINE TOOLS AND TOOL MATERIALS

As Described by the Manufacturers

New Products and Equipment for Metal Cutting Developed During the Past 12 Months

SEVERAL NEW compositions of toolsteels, as well as new methods of treating and processing that minimize carbide segregation, have been announced by the principal toolsteel manufacturers during 1946.

A higher carbon content than normally found in high speed steels is a feature of one of two new steels introduced by Vanadium-Alloys Steel Co., Latrobe, Pa., and known as Vasco Supreme (R-253).* This high carbon content results in unusual hardness and abrasion resistance. A double tempering treatment is recommended for tools made from Vasco Supreme. Tempering at 1000 to 1040° F. gives a secondary hardness of Rockwell C-67 to 68—considerably higher than the as-quenched hardness (Rockwell C-64 when oil-quenched from 2275° F.).

Brittleness is avoided by the addition of 5% vanadium which also increases the "hot hardness" of the steel at those elevated temperatures developed by friction against the metal being cut. Balance in carbon and vanadium contents results in ample toughness for all applications including intermittent cutting, and high edge-strength necessary to prevent edge crumbling. Hot hardness is further improved by the cobalt content.

The second new Vanadium-Alloys steel is Speed-Cut (R-254), a free-machining medium carbon die steel developed particularly for die-casting dies and plastic molds. The steel contains 1.12% Cr, 0.50% Mo, 0.85% Mn; it is air hardening and can be heat treated to Brinell 275 to 325 in sizes as large as 20 x 10 in. on cooling in still air. A much higher hardness is obtainable on oil quenching, and when pack hardened followed by oil quenching, a file-hard surface with high core hardness can be developed. Heat treating temperature is sufficiently low so that, in combination with the oil or air hardening properties, dimensions are practically unchanged after hardening. Speed-Cut machines as readily at Brinell 300 as other similar steels in the annealed state.

Vega is the name of a new manganese-chromium-molybdenum toolsteel made by the Carpenter Steel Co., Reading, Pa., that combines the deep hardening characteristics of air hardening steel with the low-temperature heat treatment possible with oil hardening steels (R-255). The steel has good hardness in heavy sections, hardens at low temperatures, and keeps dimensional changes in heat treatment to a minimum.

*Further information about the products described may be secured by using the Reader Service Coupon on page 54, specifying the appropriate R-number, or by writing direct to the manufacturer at the address given.

Since metallurgists (who constitute by far the largest proportion of the readers of *Metals Review*) are primarily interested in *performance* of machine tools rather than construction and operation, this review is directed primarily toward the metallurgical developments in machining operations. Equipment whose operation can be translated directly into production of an improved surface finish on metallic materials is given the most emphasis.

Tool materials naturally are of considerable interest to the metallurgist and are described in some detail. Only a few of the tools themselves are mentioned, and the new machines are merely listed under the name of the manufacturer, with a brief descriptive sentence (see page 13). Machines designed for special applications, along with accessories, fixtures, and tool and workholders, are omitted entirely as being almost exclusively of interest to the shopman.

Unusual ability to harden in very large sections is attributed to control of the carbon content. As carbon increases from about 0.40 to 0.70%, hardenability of the manganese-chromium-molybdenum air hardening steels increases sharply. Then as the carbon increases above about 0.70%, hardenability decreases. In designing Vega, carbon content was selected to provide maximum hardenability. Type analysis is 0.70% carbon, 2.00% manganese, 0.30% silicon, 1.00% chromium, and 1.35% molybdenum.

Hardening is by cooling from 1550° F. in a free circulation of air. An 8-in. diameter section tests Rockwell C-60 from surface to center; in smaller sections the hardness is slightly higher. Vega can be used for blanking tools, piercing, trimming, and forming tools for sheet metal in both light and heavy gages.

Chromovan by Firth-Sterling Co., McKeesport, Pa. (R-256), has good machinability and unusual depth of hardness when air cooled or oil quenched. Dimensional change during hardening is at a minimum. It is intended for cutting and forming dies and for some types of punches, rolls, gages, taps, reamers, lathe centers, and spinning tools.

Steels With Uniform Carbide Distribution

A process for manufacturing high speed steels and high-carbon, high-chromium die steels free from undesirable segregation is known as Desegatizing (R-257). Developed by Latrobe Electric Steel Co., Latrobe, Pa., the process insures even distribution of free carbides throughout the steel and no segregation in the center. Freedom from this segregation, heretofore regarded as a necessary evil in high speed steels, increases tool life, permits longer runs between grinds, and reduces warpage and breakage. In die steels Desegatizing provides the advantages of better machinability, safer heat treatment and longer die life.

Jessop Steel Co., Washington, Pa., in collaboration with Barium Steel and Forge, Inc., Canton, Ohio, has also developed a process for manufacturing high speed steel rounds in diameters greater than 4 in. with uniform carbide distribution. This process is known as Vee-Oginizing (R-258).

Reduction of residual strains and elimination of center bursts, as well as uniform cross-sectional carbide distribution in rounds up to 12 in. in diameter, are provided by a new forging process for toolsteels, according to Barium Steel & Forge (R-259). This so-called Shetler process involves use of a V-type bottom die and a flat top die in a hydraulic press. Starting with a square billet, the corners are progressively laid down until a round shape is obtained. The kneading action refines the structure to a degree not heretofore possible with conventional hot working methods.

A chromium-cobalt high speed steel known as M-11, especially developed for taps and threading tools, is being used exclusively by Detroit Tap and Tool Co., 8432 Butler St., Detroit, for its complete line of standard and special taps (R-260). Advantages of M-11 are good resistance to abrasion; high toughness with high hardness; a minimum of tooth breakage and chipping of the cutting edge; high red hardness; and good

torsional strength, imparting resistance to twisting and breakage, particularly under momentary overload.

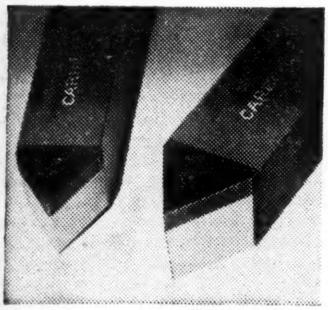
Hard Carbides

In the field of carbides new applications and adaptations in machining operations are more prevalent than new compositions. Kennametal, Inc., Latrobe, Pa., however, has developed a very hard composition known as Grade K5H, specifically for small tools used in precision boring of steel parts (R-261). Carrying a high content of tungsten-titanium carbide, it has a Rockwell hardness of A-93.2 and good resistance to cratering; it is unusually strong for such a hard material.

Metal Carbides Corp., Youngstown, Ohio, reports the development of two new grades of tungsten carbide suitable for fabrication into blanking, piercing and lamination dies, bolt dies and impact extrusion dies (R-262). These grades are designated as Talide C-7525 and Talide C-8020.

Grade C-7525 has a hardness of Rockwell A-83 to 84, a transverse rupture strength of 365,000 psi., and a deflection strength (Young's modulus) of 70,000,000. Grade C-8020 has a hardness of Rockwell A-85 to 86, a transverse rupture strength of 310,000 psi., and a deflection strength of 77,000,000.

These new grades have superior resistance to shock and are proving successful on severe heading and extrusion jobs in the bolt and nut industry, on impact extrusion of collapsible aluminum tubes, and for dies producing razor blades, motor laminations and other metal products which are blanked, pierced, perforated and stamped. They are also being used in swaging dies used to form and shape both solid and tubular metal forms into pens, pencils, golf club shafts, pliers, bicycle tubing, and needles.



Carboloy Turning Tools

Carboloy Co., 11177 East Eight Mile Rd., Detroit, tells how substitution of standard Carboloy turning tools in place of high speed steel tools on a certain facing operation increased life between grinds tenfold (R-263). The operation consisted of facing plunger pins of S.A.E. 1035 bar stock. When standard Carboloy T-41 tools were installed, in place of high speed steel tools, tool life between resharpenings jumped from 1000 to 10,000 pieces.

Informative Manuals

Several informative and instructive booklets on tool materials and machining operations have been issued during the past year by the manufacturers, notably the 32-page brochure entitled "Cutting Tool Materials" published by Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh (R-264). It analyzes the comparative fields of usefulness of high speed steel, cast alloys and carbides as cutting tools, with a comprehensive correlation of the basic characteristics, properties and functions of the three broad types. Comparison charts are in color, attractively and readably arranged.

Crucible Steel Co.'s 30-page booklet (R-265) entitled "Toolsteels for the Nonmetallurgist" is a series of articles intended for the shopman (Crucible Steel Co. of America, 405 Lexington Ave., New York 17). The articles explain the characteristics of the different types of toolsteels, outline the purposes for which each is best adapted, and give suggestions for heat treatment of each group.

The 26th edition of "Handbook for Drillers" (R-266), recently published by Cleveland Twist Drill Co., 1242 East 49th St., Cleveland 14, is intended as an introduction to the theory underlying the use of the twist drill. Its five chapters explain the parts of a twist drill, give points on grinding, drill speeds and feeds, instructions for drilling various materials, and discuss common errors. Tables of cutting speeds, thread dimensions and tap sizes are included.

Lapointe Machine Tool Co., Hudson, Mass., has a 124-page instruction manual (R-267) that contains detailed descriptive data plus complete instructions for installation, operation, service and maintenance of standard broaching machines.

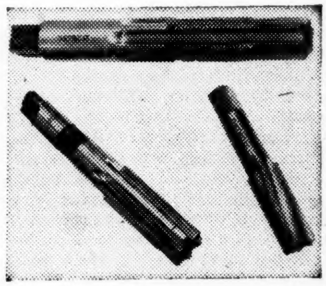
A new booklet by the Cross Co., 3250 Bellevue Ave., Detroit 7, explains high speed gear tooth pointing and chamfering methods (R-268). The actual generating action utilized in Cross's continuous rotary cutting motion is clearly detailed in text and diagrams. Close-up photographs illustrate such operations as pointing internal clutch teeth of a synchromesh second speed automotive gear, pointing teeth of a first speed and reverse truck gear, chamfering internal spline of an aircraft gear, and chamfering teeth of a large aircraft timing gear and removing burr.

The importance of economical and accurate cutter maintenance, using the crush wheel process, is stressed and explained in detail.

Machining Practices

Two good booklets on machining of stainless steel are also available. Carpenter Steel Co.'s 116-page notebook (R-269)* contains detailed information on various operations such as turning, drilling, tapping, threading, milling, broaching, reaming, filing, and sawing. Each chapter contains a complete check chart that diagnoses the troubles that can arise and gives shop tips on how to cure them. A final chapter discusses proper lubricants and coolants for various types of jobs.

Typical stainless parts are shown and blueprints illustrate unusual or difficult machining jobs that have been done at a profit in various plants. Special tables indicate recommended speeds and feeds for machining different types of stainless steel.



Taps Made of Chromium-Cobalt High Speed Steel M-11

A similar publication is "Shop Notes on the Machining of Stainless Steel" (R-270) published by Rustless Iron and Steel Div. of Armco, Baltimore, Md. Four simple general rules are given, followed by specific recommendations for various operations. An approximate toolsteel selection chart gives relative advantages of five types of toolsteels for 16 operations.

A new free-machining plate stock, E-Z-Cut Plates, is a product of Joseph T. Ryerson & Son, Inc., P. O. Box 8000-A, Chicago 80 (R-271). The free-machining characteristics are imparted by manganese sulphides, which are finely and uniformly dispersed throughout the steel. High machine speeds are essential to secure the fullest advantage of this plate. It is readily amenable to carburizing.

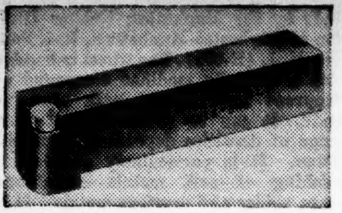
New Tools

Since metallurgical information about the new tools introduced during the past 12 months is either lacking or of secondary importance, only a few developments, of more than passing interest to metallurgists, will be described.

One of these is a copper-cushioned toolbit made by General Tool & Die Co., 555 Prospect St., East Orange, N. J. (R-272). A copper cushion or shim, 1/32 to 1/16 in. thick, brazed to the bottom of the toolbit, helps to absorb shock on the cutting edge and minimizes the possibility of the tool shifting in the holder.

Toolbits are ground in the annealed state, then tumbled before hardening. By removing sharp edges and tool marks, the chances of warping and cracking in heat treatment are minimized. The steel is heated to maximum hardening temperature. In brazing, the

*This book is available to production and management executives at no cost. Additional copies for men in the plant are offered at 50¢ each. Address request to Carpenter Steel Co., Reading, Pa.



Tool With Kennametal Solid Round Clamped-In Insert

upper third of the toolbit is left at maximum hardness, while the lower two-thirds is drawn back to a hardness gradient. Laboratory tests indicate that the impact resistance of cushioned tools is at least twice that of conventional high speed steel tools.

Two kinds of high speed steel are used—12% cobalt and a special high-carbon, high-vanadium steel. The first is copper plated and the second cadmium plated for identification. They can be ground with conventional grinding wheels.

These cushioned tools are available as toolbits, planer and shaper tools, form tools, and toolbits or cutter blades for insertion in milling cutters.

High speed taps treated by an "electrolizing" process, which combines high voltage with a chemical bath and a rare metal to produce an exceedingly hard case on the cutting edges and the entire surface of the tap, have been offered by the Electrolized Tap Corp., 148 West River St., Providence, R. I. (R-273). The process deposits a very thin surface (0.00003 in.) of an unusually hard alloy which reduces chip and surface friction. Hardness of the case is Rockwell C-83. Because of the thinness of the deposit, dimensional accuracy of the tap and of the thread it produces is unaffected.

An ejector-type tool designed by Super Tool Co., 21650 Hoover Rd., Detroit (R-274), is illustrated in the diagram. The solid replaceable carbide

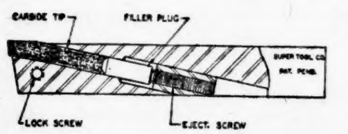


Diagram of Ejector-Type Tool Made by Super Tool Co.

bit is securely held with the pressure distributed over its entire length, and can be extended for resharpening simply by turning the recessed ejector screw.

Comparative tests were made using a brazed carbide-tipped tool and the new ejector-type tool on the machining of cast iron columns 4 ft. long by 7 in. in diameter with a 1¼-in. slot running lengthwise. The diameter of the columns had to be machined to 6 in. in one operation. Feed per revolution with the brazed tool was 0.035 in. and with the new tool 0.051 in.; production per grind was 1 to 1½ columns as compared to 5 columns, and tool breakage that was 40% with the brazed tool was nonexistent with the ejector tool. Savings using the ejector tool figured to about five-sixths of the total tool cost.

A clamping arrangement is utilized by Kennametal, Inc., Latrobe, Pa., to hold solid Kennametal (carbide) inserts in several new tools. One of the most recent is a solid round insert, each end of which provides a circular cutting edge (R-275). This is clamped on end in a steel holder, and supported by a back-up adjusting screw. Only a small section of the edge bears against the work. When it becomes dull the clamping screw is loosened, the round is revolved around its axis to provide a new cutting edge, and the clamping screw is then retightened. When all of the cutting edge of one end of the round has become dull, the round is turned end-for-end to provide another cycle of cutting.

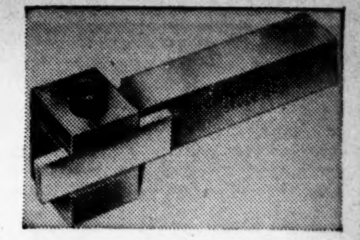
A similar clamping arrangement is incorporated in another new line of tools for single grooving or cutting-off operations (R-276). These tools utilize specially formed Kennametal blades securely clamped in position. The blade can be extended time and again, after each resharpening, until about half its length has been utilized. The rigidity of the blade prevents "weaving"; it stays sharp for an extended period of time, and can be reground many more times than a conventional brazed-in tip tool.

The same principle is incorporated in Kennametal's broad-nose tools for turning cast iron rolls described in detail in the December 1946 issue of *Metals Review* (R-277). The blade in this tool has four cutting edges that may be used in succession. Then it can be reground time and again (long sides only) and advanced each time to cutting position until two-thirds of the blade has been used up.

A novel device for providing a bearing surface for tapped threads in light metals, plastics and other materials, is a helical coil of stainless steel wire. Known as Aero-Thread and Heli-Coil inserts, they are used where wear of the tapped threads is likely to occur, according to the manufacturer, the Aircraft Screw Products Co., Inc., Long Island City, N. Y. (R-279). The wire is formed into a diamond cross section and inserted into the tapped thread with a special inserting tool. The insert is slightly larger than the tapped hole, but is constricted by the inserting tool so that it can be installed readily. When released, the spring tension in the coil forces the outer edges snugly into the tapped thread holding the insert in place.

Cutting Fluids

Development of the dual and triple-purpose cutting fluid which can be used as a machine lubricant, hydraulic medium and cutting fluid in the operation of single and multiple-spindle automatic screw machines has been a great timesaver, according to C. W. Lockwood of the technical and research division, Texas Co., 135 East 42nd St.,



Kennametal Grooving Tool

New York 17 (R-280). The proper type of multiple-purpose lubricant eliminates the effect of dilution of the cutting oil by the lubricant and hydraulic medium. This improved cutting fluid has increased tool life and machine output, decreased scrap, and reduced unit production cost.

Use of straight or compounded mineral oil as grinding coolants is increasing, and to obtain maximum results special products must be developed, Mr. Lockwood points out. Forms considered impossible to grind economically heretofore are now being ground at low cost and high speeds after the adoption of oils as grinding coolants.

During week-end or longer plant shutdown, soluble oil emulsions or water solutions have been plagued by the so-called "Monday morning odor", namely, hydrogen sulphide which develops in the emulsions or water solutions from bacteria in the water. Soluble oils specially prepared retard this bacterial growth and eliminate the hydrogen sulphide odor without sacrificing the protective qualities of the oil.

A new soluble oil called Kelco Protectal (R-281) made by the J. W. Kelley Co., 3401 West 140th St., Cleveland 11, has unusually good rust protection. When cut back with 50 to 60 parts of water it can be used on gray or malleable iron, and on grinding or cutting steel it can be cut back with 70 to 90 parts of water. Shop reports also show better finish on aluminum and other nonferrous metals when ground with this emulsion. New germicides protect the operators, and the oil remains stable and odorless over a long period of time.

Gulf soluble cutting oil (R-282) combines the qualities of high lubricating value, extreme stability, pleasant odor, and nonfoaming and rust preventive characteristics, with all-water miscibility. Recommendations for proper dilution for specific machining operations will be furnished on request to Gulf Oil Corp., Pittsburgh.

Low cost is featured by Quaker Chemical Products Corp., Conshohocken, Pa., for its Quaker Kut 85 (R-283). This is a honey-colored, odorless base that can be blended with mineral oils for machining. Blending the base with 100-viscosity or 250-viscosity oil or kerosene simplifies the problem of oil storage and handling without sacrifice of production efficiency. Quaker Kut 85 can be blended in bulk storage tanks, at the oil reclamation tank, in a drum, or right in the machine.

Quaker also has a new water-soluble

Sapphire Products Gun-Type Applicator for Diamond Dust Compound

grinding fluid called Microgrind 70 (R-284). It is a low-viscosity liquid which will form a true solution with water of all hardnesses, and will not become rancid when mixed with hard water or when used for grinding cast iron. It has a highly detergent action on abrasive wheels, keeping them open and free-cutting.

Grinding and Finishing

As pointed out by Mr. Boulger in the preceding article (page 5, column 1), the specification of surface finish is becoming increasingly common. The importance of surface finish to the metallurgist is reflected in the many new grinding wheels, lapping, honing and polishing compounds, abrasives and finishing materials that have been described by the manufacturers in recent metallurgical publications. Some of the important products in this field are described in what follows; grinding and honing machines are merely listed briefly on pages 13 to 15 under the name of the manufacturer.

A new abrasive known as Alundum 32 (R-285) is described by Norton Co., Worcester 6, Mass., as the first major improvement in aluminum oxide abrasive since its introduction over 40 years ago. From improvements in the electric furnace process used in its manufacture, each grain is a complete single crystal which does not require crushing to size; the grains are of a chunky, nubbly shape with sharp points on all sides. No matter how they are bonded into a grinding wheel, one or more cutting points are always exposed in the wheel surface.

The new Alundum 32 abrasive has a purity of over 99%, and has no slag and no pores. This compares to the 95% abrasive and 5% slag composition of the "regular" type aluminum oxide abrasives, and the 99% purity of the "white" type, which, however, contains a large percentage of pores. The great number of long-lasting cutting points means that the grinding wheel removes stock rapidly and with less heat generated. The points do not dull quickly and since there are more of them doing the work, fewer dressings are required.

Use of diamond dust for final finish on machined parts is exemplified in the lapping system originated by Sapphire Products Division of Elgin National Watch Co., Aurora, Ill. (R-286). Elgin graded virgin diamond powder is compounded in a viscous vehicle which disperses the individual diamond particles uniformly and keeps them permanently suspended. The compound is nontoxic and nondeteriorating; it has high clinging properties and may be used on high-speed laps with a minimum of throw-off.

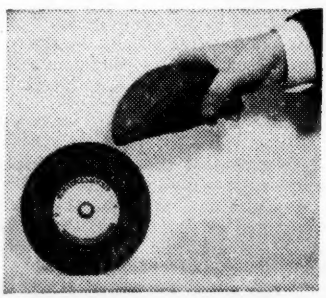
The compound is enclosed in a gun-type applicator which meters the quantity of diamond for most economical application. Replacement cartridges are furnished in transparent tubes so that the color which distinguishes the diamond particle size is in view at all times.

In addition to finishing high-precision devices such as watch parts, and dimensional control equipment such as gages, much of this material has been used in the finishing of surfaces of hardened steel molds used for permanent mold casting and plastic molding.

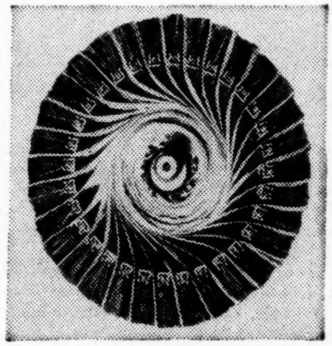
A metal-bonded diamond cup wheel to be used for honing has been put on the market by the Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill. (R-287). The cup wheel is made in diameters of 3 and 4 in. and 500 mesh. It is mounted on the inside of the 6 or 7-in. diamond wheels used on standard carbide tool grinders, and provides a fine cutting edge in a few seconds with one stroke across the honing wheel. Precision Diamond Tool Co. also has a 20-page catalog containing much engineering data on the proper application of diamond tools (R-288).

A vitrified-bonded diamond abrasive (R-289) produced by Bay State Abrasive Co., 21 Union St., Westboro, Mass., has the advantages of high strength and rigidity, plus fast, cool cutting action. This company has also introduced Bayflex cut-off wheels incorporating abrasive in a cotton fiber bonding (R-290). The increased toughness and adaptability of this new bonding material provide safer and faster cutting of nonferrous metals.

Flexibility and cushion action in a soft-bonded finishing wheel are demonstrated by the latest addition to the line of polishing and finishing wheels made by the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J. (R-291). The wheel is bonded with a specially modified compound of Neoprene impregnated with abrasive grain. It can be varied over a wide range of densities depending on application. It is particularly adapted to finishing of soft metals—aluminum, brass, solder and precious metals. It is supplied in either fine abrasive grain or with pumice, rottenstone or other mild abrasives, and is effective in blocks and rubbing pads as well as in wheel form.



Manhattan Flexible Wheel



Vonnegut Brush-Backed Abrasive Head for Polishing Aluminum

The Vonnegut brush-backed abrasive head (R-292) has been adapted to give a satin finish to extruded, cast and spun aluminum alloys. It is produced by the Vonnegut Moulder Corp., 1819 Madison Ave., Indianapolis, Ind. Flexibility of the brush-supported abrasive facilitates the application of the cutting element to curves and irregularly shaped surfaces; it can also be used to remove burrs or light flashes.

Coated cloth abrasive is furnished in either solid or shredded strips of the appropriate grade. Strips are assembled in groups of four; eight assemblies, containing approximately 48 lineal ft. of cloth, constitute one loading. The loading is locked in a coiled position within the head with the ends of the strips projecting slightly beyond the periphery of the brushes. As the exposed abrasive wears down and loses its cutting efficiency, additional cloth is released from the inner coil. Readjustment of the abrasive requires approximately 1 min., while the entire loading may be replaced in 5 min.

An all-purpose grinding wheel (R-293) that will operate on any kind of material — hardened alloy toolsteels, annealed steel, stainless, monel, bronze, aluminum, brass and hard plastics—has been introduced by DoAll Co., 1301 Washington Ave., South, Minneapolis 4, Minn. The wheel works equally well for heavy, fast, roughing cuts and fine finishing. It produces a precision finish comparable to that of a 300-grit wheel, and can be used on all types of grinding machines. The bond is insoluble and is not weakened by coolants; the open structure of the wheel keeps the work cool even when dry grinding.

Machine Tools

The following list of new machine tools is not intended to cover the field completely; ample information concerning those listed here, and many more besides whose interesting features are primarily mechanical, may be readily found in the regular issues of *American Machinist*, *Machinery*, and other similar publications.

Lathes

American Tool Works Co., Cincinnati 2, Ohio—Hydraulic DUPLICATING LATHE will reproduce from a templet mounted at the rear of any shaft having an irregular contour including steps, tapers, right angle or tapered shoulders, recesses, grinding necks, and radii. (R-295)

ROLL-GROOVING LATHE for turning and forming irregular grooves in forging rolls is equipped with specially designed tool-rest with cam-actuated tools for simultaneously varying the width and depth of the grooves. (R-296)

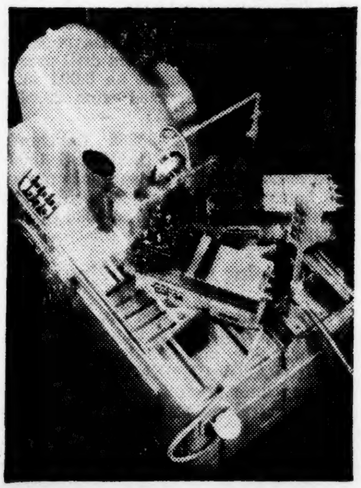
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10—Simplified DUPLICATING ATTACHMENT designed to produce contours which exactly correspond to a sheet metal templet or master part. (R-297)

Cross Co., Detroit 7—Machine for FACING AND CENTERING SHAFTS on both ends will turn out 50 average shafts per hr. (R-298)

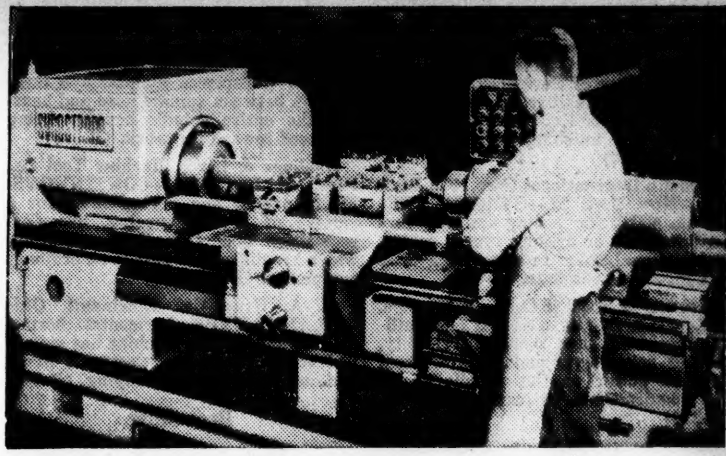
Crozier Machine Tool Co., 654 North Prairie Ave., Hawthorne, Calif.—Lathe with built-in wet VACUUM PUMP holds workpieces without chuck or collet. (R-299)

R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio—CRANKSHAFT LATHES with fast, automatic production; four new models for rough or finish turning all pin bearings, for rough turning all line bearings, for rough and finish turning of line bearings, and for finish turning of line bearings. (R-300)

DUAL DRIVE is built with a gear drive and a direct belt drive and has eight speeds in the low range and four in the high range for use with carbide tools. (R-301)



Monarch Uni-Matic Equipped With Two Tool Slides



Sunstrand Model 16 Automatic Lathe Can Be Used for Either Shaft Turning Jobs or Chucking Work

Monarch Machine Tool Co., Sidney, Ohio—UNI-MATIC TURNING MACHINE is equipped with one to three individually motor-driven tool slides which can be grouped about the spindle in whatever arrangement will best apply the cutting tools to the work. (R-302)

MONA-MATIC is designed specifically as a manual or semi-automatic machine for doing first and second operation work on gear blanks, straight and flanged bushings and shafts with one or more steps. (R-303)

SPEEDI-MATIC hand screw machine is designed to handle small turning work quickly and simply in quantities of 25 to 500 pieces. (R-304)

TOOLMAKER'S LATHES—Model EE 10-in. sensitive precision lathe with high sustained operating speeds; and a universal toolmaker's lathe developed expressly for mold-makers. (R-305)

Contour machining control, AIR-TRACER licensed from Bailey Meter Co., for attachment to new Monarch lathes. (See Bailey Meter Co., Duplicating attachment.) (R-306)

Hardinge Brothers, Inc., Elmira, N. Y.—High speed PRECISION LATHE, recently redesigned, has hardened and ground steel dovetail bed forming a solid bed top with no weakening center slot. (R-307)

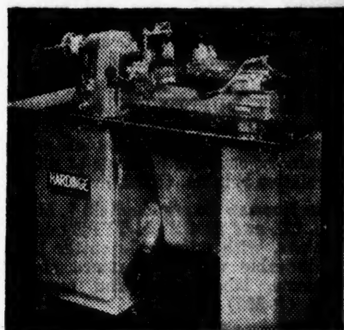
SECOND OPERATION MACHINE affords sustained accuracy through use of antifriction bearing and hardened and ground steel surfaces. (R-308)

National Acme Co., 170 East 131st St., Cleveland 8—CHUCK-MATIC, designed for carbide tooling, has single air-operated chuck to hold the work and will handle production machining operations on castings, forgings, and tubing parts up to 12 in. in diameter. (R-309)

Seneca Falls Machine Co., Seneca Falls, N. Y.—DOUBLE-END DRIVE automatic lathe for turning valve guides and similar parts will rough and finish turn in the same operation with separate tools. (R-310)

Snyder Tool and Engineering Co., 3400 East Lafayette St., Detroit 7—Center-drive, double-end TURNING MACHINE FOR SHAFTS; front tool slides are for turning the various diameters and forming a taper on one end, while rear tool slides are for facing, chamfering or undercutting. (R-311)

Springfield Machine Tool Co., Springfield, Ohio—HYDRAULIC PROFILING and duplicating machine will duplicate any job from bottle molds to complicated cam forms, either interior or exterior; any type of templet may be used. (R-312)



Hardinge Second Operation Machine Has Dovetail Solid Bed Top

Sundstrand Machine Tool Co., Rockford, Ill.—Model 16 AUTOMATIC LATHE has quick-cycle changeover permitting multiple tooling for short runs as well as for production turning. (R-313)

Milling Machines

Childs & Co., 204 16th St., Conneaut, Ohio—SMALL KNEE-TYPE milling machine, Model 0000, features low cost and accuracy for manufacture of small parts and tools, for die shops, laboratories, and for instrument-makers, watchmakers and gunsmiths. (R-314)

Cincinnati Milling Machine Co., Cincinnati 9, Ohio—HYDROMATIC milling machines have been redesigned for high-speed carbide milling, with heavier construction, larger motors, increased cutting capacity and higher spindle speeds. (R-315)

Davis & Thompson Co., 6411 West Burnham St., Milwaukee 14, Wis.—No. 2-B ROTO-MATIC MILLER for continuous milling of the parallel faces of transmission cases has work automatically clamped and carried through the roughing and finishing cutters successively. (R-316)

Gubelin International Corp., 336 Park Ave., New York 22.—SWISMA VERTICAL MILL for milling accurate vertical surfaces or drilling round, square or hexagonal holes in sizes from 5/32 to 1 in. across the flats. (R-317)

Kearney & Trecker Corp., Milwaukee, Wis.—CSM line of KNEE-TYPE milling machines have increased rigidity, greater horsepower and more uniform flow of power to the spindle to fit the requirements of carbide milling. (R-318)

Kent-Owens Machine Co., Toledo, Ohio—VERTICAL MILLER has independent adjustment of the feed rate for opposite directions of table travel so that while a part is milled at slow feed rate at one end of the table, another job can be set up at the other end requiring a faster feed. (R-319)

W. H. Nichols & Sons, Waltham, Mass. — Power TABLE-FEED ATTACHMENT for the Nichols miller offers rapid approach, maximum proper cutting feed, fast table return and shutoff. (R-320)

Reed-Prentice Corp., Worcester, Mass. —VERTICAL milling machine for toolroom work has centralized electronic control, a universal head, and almost infinitely variable feeds and spindle speeds, facilitating such operations as die sinking, duplicating, boring, drilling and face or straddle milling. (R-321)

Sundstrand Machine Tool Co., Rockford, Ill. — DUPLEX-TYPE RIGIDMILL No. 0 mills two surfaces simultaneously on opposite ends of small workpieces; cuts can be made at different relative heights. (R-322)

Van Norman Co., Springfield 7, Mass. —No. 22L and 22M RAM-TYPE milling machines, with adjustable cutter head and movable ram for pattern shops, toolrooms, laboratories and machine shops. (R-323)

NO. 2 HEAVY HORIZONTAL milling machine has heavy built-in spindle flywheel and exceptionally rigid spindle. (R-324)

Boring and Planing

Cincinnati Planer Co., Oakley, Cincinnati 9, Ohio—HYPRO automatic boring and turning mill bores and turns rolled steel wheels at an average of 6 per hr.; new chucking method centers the wheel so that rim thickness is balanced. (R-325)

Cleereman Machine Tool Co., affiliated with Bryant Machinery & Engineering Co., 400 West Madison St., Chicago—JIG BORER, Master Model 1836, has quill made of nitralloy, which in combination with the Meehanite bearing surface of the spindle head, showed no measurable wear in two years of continuous use on an experimental model. (R-326)

Cosa Corp., 405 Lexington Ave., New York—SIP JIG BORER of planer type has built-in measuring screws and micrometer heads so that direct readings are made to 0.00005 in. (R-327)

General Engineering & Mfg. Co., St. Louis, Mo.—BORING AND FACING machine for operations on heavy, cumbersome workpieces maintains a fixed relation between spindle nose and bearing, the entire spindle housing being advanced toward the work. (R-328)

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.—CONTINUOUS-FEED facing and boring head for a variety of boring, turning, grooving, recessing, and threading operations which are difficult to handle on ordinary equipment. (R-329)

G. A. Gray Co., Cincinnati, Ohio —PLANER-TYPE horizontal boring, drilling and milling machine has simplified control methods, electronic drive, and automatic power clamping. (R-330)

Broaching

Acme Broach Corp., East 3rd St. at Delaware, Lexington 47, Ky.—HYDRAULIC HORIZONTAL broaching machines and presses can be readily changed from one job to another by changing to the proper size of face plate or work horn and inserting and aligning the proper broaching tool. (R-331)

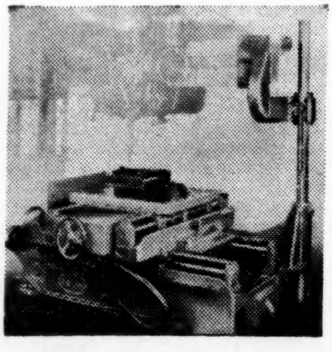
American Broach and Machine Co., Ann Arbor, Mich. — HORIZONTAL broaching machine, Type HD, has a machine bed of rolled steel construction that forms double walls through the bed and lends greater strength and rigidity to the base than can be obtained with a single-walled cast iron or steel bed. (R-332)

Colonial Broach Co., Box 37, Harper Station, Detroit 13—Air-operated eccentric FIXTURE-OPERATING MECHANISM eliminates the necessity of manual broach handling and permits broach to be returned through the bore of an unbroached part without dragging. (R-333)

Drilling

Bullard Co., Bridgeport 2, Conn.— MAN-AU-TROL SPACER, a heavy, flat table which moves either laterally or longitudinally on its base under an accurate drill spindle fixed rigidly in one position gives pinpoint precision in the drilling of holes without the use of jigs, and at a timesaving of 20% or better. (R-334)

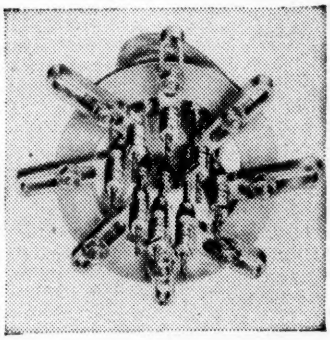
Cincinnati Bickford Tool Co., Cincinnati, Ohio—UPRIGHT drilling machine has 16 speeds and eight feeds; a direct-reading graduated scale facilitates drilling to exact depth within 0.005 in. (R-335)



Bullard Man-Au-Trol Spacer

Cleveland Tapping Machine Co., 3610 Superior Ave., Cleveland—HORIZONTAL COMBINATION drilling and tapping machine with automatic clamping is for pieces up to 96 in. long. (R-336)

Commander Manufacturing Co., 4225 West Kinzie St., Chicago 24—Model 900 MULTIDRILL contains up to eight spindles; light-weight high-strength aluminum alloy cast parts permit the counterspring of even the lightest drill press to take up the weight. (R-337)



Commander Multidrill

Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11—CENTER drilling machine has automatic centering and clamping, single lever control of clamping and feed mechanism. (R-338)

Edlund Machinery Co., Inc., Cortland, N. Y.—DRILL-O-MATIC will automatically perform intricate and precision drilling, countersinking, counterboring, spot facing, reaming and tapping operations on a wide range of workpieces. (R-339)

Kaukauna Machine Corp., Kaukauna, Wis.—SERIES 125 PORTABLE universal drilling and tapping machine has a head that swivels 360° in either the horizontal or vertical plane making it possible to drill and tap at any angle in any plane within the limits of travel of the machine units. (R-340)

Massasoit Machine Co., 232 Grove St., Waltham, Mass.—Lord & Davis SUPERSENSITIVE high speed drill press will drill holes as small as 0.004 in.; speed has been increased from 23,000 to 25,000 r.p.m. (R-341)

Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland 17—GEARLESS 1500 series multiple drillhead can drill up to 8700 holes per hr.; speed of drills can be predetermined from 10 to 3000 r.p.m. (R-342)

Tapping and Threading

James Coulter Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.—Type H hob threading machine has new RELIEVING ATTACHMENT so that taps with any number of flutes with eccentric or central reliefs can be produced. (R-343)

Landis Machine Co., Waynesboro, Pa.—Universal CENTERLESS thread grinder is fully automatic and can grind screw threads on straight cylindrical workpieces as well as on headed or multiple-diameter parts. (R-344)

Rolled Thread Die Co., 237 Chandler St., Worcester 2, Mass.—Model A22 Reed THREAD-ROLLING machine supports and places work vertically between three synchronously rotating cylindrical dies that hold it rigidly in the proper position. (R-345)

Watson-Flagg Machine Co., Paterson, N. J.—Model C precision THREAD ROLLER designed to produce Class 4 fits has accuracy built into the die rolls rather than being dependent on the skill of the operator. (R-346)

Grinding and Honing

Arter Grinding Machine Co., Worcester, Mass. — Rotary SURFACE GRINDER, Model D, is so constructed as to insure freedom from any vertical cam action so work can be ground to exceptionally close limits on thickness and parallelism. (R-348)

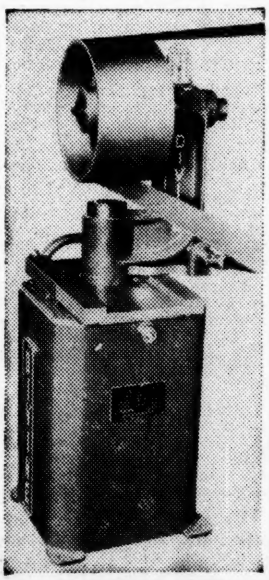
Black & Decker Mfg. Co., Towson 4, Md.—Heavy duty BENCH GRINDER has light weight, extra safety features, improved support in tool sharpening. (R-349)

Bryant Chucking Grinder Co., Springfield, Vt.—Precision automatic INTERNAL GRINDER is designed for high production in grinding bores from 5/16 up to 3½ in. in length. (R-350)

Cincinnati Grinders, Inc., Cincinnati 9 — Four precision CENTER-TYPE plain grinding machines come in 6, 10 and 14-in. sizes. (R-351)

Colonial Broach Co., Box 37, Harper Station, Detroit 13—Flat BROACH SHARPENING MACHINE, Model FS3-36, has Lazy-Reach lever which makes it possible for operator to grind flat surface broaches several feet long while seated. (R-352)

Cosa Corp., 405 Lexington Ave., New York 17—Fritz Studer type PSM precision PROFILE GRINDING machine for profile gages, form tools and sectional dies grinds flat workpieces 2 in. thick and 6 in. long and circular work 4 in. in diameter to an accuracy of 0.0002 in. (R-353)



Divine Bros. Backstand Idler

Divine Brothers Co., 200 Seward Ave., Utica 1, N. Y.—BACKSTAND IDLER, the DB3, for abrasive belt polishing has visible indicator showing belt tension at all times; a calibrated spring under compression loading keeps belts tight with smooth, straightline pull. (R-354)

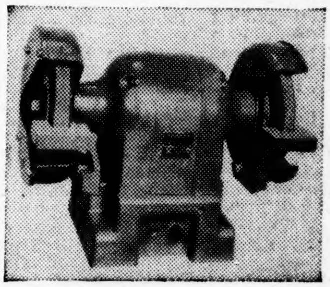
DoALL Co., Des Plaines, Ill.—Model GH hand-operated toolroom SURFACE GRINDER features smooth, easy table action. (R-355)

E. F. Hager and Son, 98-02 217th Lane, Queens Village 9, N. Y.—CARBIDE TOOL GRINDER has reciprocating action built into the toolholder which assures exact angles even with unskilled operators. (R-356)

Hammond Machinery Builders, Inc., Kalamazoo 54, Mich.—7-in. CARBIDE TOOL GRINDER is of heavy duty construction for use of diamond wheels. (R-357)

Model CB-77 COMBINATION CHIP BREAKER and diamond finishing grinder accommodates either 6 or 7-in. diameter wheels. (R-358)

New ABRASIVE BELT GRINDERS include the Model VH-6 using a 6 x 60-in. belt for wet or dry grinding, the Model 5 equipped with either one or two abrasive belts up to 3 in. in width, and the Model F-2, a small machine using a 48-in. belt 2 in. wide. (R-359)



Black & Decker Bench Grinder

Triplex Machine Tool Corp., 127 Barcley St., New York 7—Lidkoping CENTERLESS GRINDERS of heavy construction have a speed of 100 ft. per min. in grinding steel shafts. (R-360)

Porter-Cable Machine Co., Syracuse 8—Centerless WET BELT GRINDER has endless abrasive belt in balance with the resilient contact roll so that wear on the roll is minimized. (R-361)

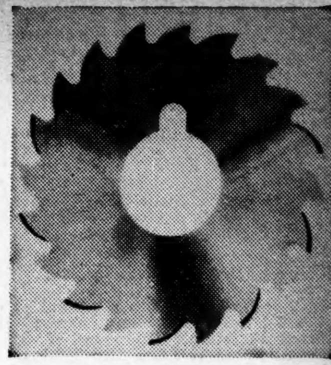
Sheffield Corp., Dayton, Ohio—Precision ANNULAR FORM GRINDER utilizes "Crushtrue" principle of wheel dressing. (R-362)

TEMPLET GRINDER with electronic control and 20-power microscope grinds templets and other work up to 72 in. long, 8 in. deep and 1 in. thick without repositioning. (R-363)

Size Control Co. Division, American Machine & Gage Co., 4636 West Fulton St., Chicago 44—Model 100 CENTERLESS LAPPING machine gives precision finish of less than 2 microinches. (R-364)

Sawing and Cutoff Equipment

DoALL Co., 1301 Washington Ave., South, Minneapolis 4, Minn.—Zephyr 16 high-speed metal-cutting BAND SAW will cut ⅛-in. stainless steel at 50 lineal in. per min., 13-gage sheet steel at 150 in., 75S-T aluminum alloy at 100 sq. in. (R-365)



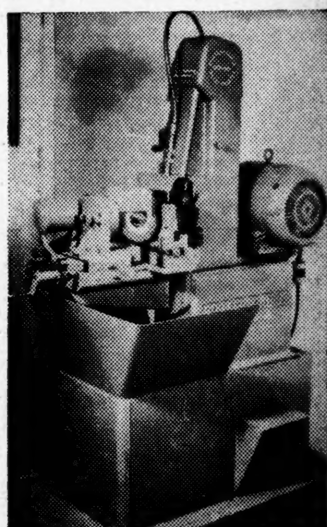
Martindale Metal-Cutting Saw Has Alternately Beveled Teeth

Martindale Electric Co., Box 617, Edgewater Branch, 1408 Hird Ave., Cleveland 7—High speed steel METAL-WORKING SAWS in four new types are for screw slotting, for more general slitting and cutting on hard metals, and for cutting softer metals in hook tooth and formed tooth types with wide gullets for efficient chip clearance and alternately beveled teeth which produce chips smaller than width of cut. (R-366)

Millers Falls Co., Greenfield, Mass.—TENSIOMETER designed to set and maintain correct blade tension in power hacksaws is a small cylinder enclosing a strong, calibrated spiral spring. (R-367)

Motch & Merryweather, Cleveland—No. 2 hydraulic feed and hydraulic clamping METAL-SAWING MACHINE cuts ferrous and nonferrous metals up to 6 in. round, square or multiple stock, or up to 12 x 5-in. standard L-beams. (R-368)

Pines Engineering Co., Aurora, Ill.—Automatic CUTOFF ATTACHMENT for tube and pipe benders saws through the tube by hydraulic power after the bend is finished and the mandrel extracted but before the clamps are opened. (R-369)



Latest Model of Porter-Cable Wet Belt Grinder

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month

1 ORES & RAW MATERIALS Production; Beneficiation

1-16. Utvinning av Mineralprodukter ur Avfall Fran Järnmalmsanrikningsverk Genom Flotation. (Recovery of Oxide Mineral Products From Mill Tailings by Means of Flotation.) G. G. Bring. *Jernkontorets Annaler,* v. 130, no. 11, p. 605-648.

Selective flotation for recovery of apatite, hematite, mica and lime from tailings from magnetic concentration of iron ore, using oleic acid and soaps as collectors. Experimental work presented in tables and charts.

1-17. The Development of Metallurgical Practice for the Treatment of Nchanga Mixed Oxide-Sulphide Ores. H. L. Talbot. *Bulletin of the Institution of Mining and Metallurgy,* Jan. 1947, p. 1-29.

Development of a crushing, grinding, classifying, and flotation flow sheet for a complex copper ore.

1-18. Lamp Filament to Atomic Pile. *Chemical and Engineering News,* v. 25, Jan. 27, 1947, p. 236.

Westinghouse development of commercial production of uranium, zirconium, and thorium.

1-19. Crushing and Grinding. Lincoln T. Work. *Industrial and Engineering Chemistry,* v. 39, Jan. 1947, p. 11, 31.

Recent developments. 26 ref.

1-20. Flotation. Fred D. DeVaney. *Industrial and Engineering Chemistry,* v. 39, Jan. 1947, p. 26-27.

A survey of recent developments. 28 ref.

1-21. Short History of Progress Used to Date on Intermediate Ores. Peter Warhol, A. E. Matson and Louis J. Erck. *Skillings' Mining Review,* v. 35, Feb. 1, 1947, p. 1-2, 6, 15.

Progress in beneficiation of iron ores in Minnesota. Installations and types of ores and concentration problems to be solved.

1-22. Pilot-Plant Production of High-Grade Magnetite Concentrates, Cranberry, N. C. Frank D. Lamb and D. A. Woodard. *Bureau of Mines Report of Investigations* 3980, Dec. 1946, 7 p.

Work was initiated to provide a source of high-grade iron ore for experimental sponge iron production. Concentrates assaying 70.3% Fe were obtained by grinding to −65 mesh, followed by magnetic separation. Proposed flow sheet and cost estimates.

1-23. Mineral-Dressing Characteristics of the Red Iron Ores of Birmingham, Ala. Will H. Coghill and G. Dale Coe. *Bureau of Mines Bulletin* 464, 1946, 99 p.

Geography and geology; a historical review of mining, smelting and milling; the present status of the industry; the most recent, hitherto unpublished work of the Southern Experiment Station of the Bureau, on the beneficiation and appraisal of ores and iron-bearing strata of Red Mountain.

1-24. The Principles Underlying the Sintering of Iron Ores. R. Hay and J. M. McLeod. *Journal of the West of Scotland Iron & Steel Institute,* v. 52, Session 1944-45, p. 109-121.

An extension was made of the mechanism of formation, the micro and macrostructure, composition, and reducibility of various classes of sinters in order to help solve the problem of production of a sinter as reducible as natural ore yet of sufficient strength for good gas permeability. The laboratory experiments show that great improvement in present sintering technique is possible. 17 ref.

1-25. Iron Ore Beneficiation in Germany. *Iron Age,* v. 159, Feb. 6, 1947, p. 57.

Iron ore beneficiation plants supplying the Hermann Göring works, at Salzgitter, in Southwest Germany, together with information regarding ore supplies for these works taken from recent report by a metallurgical team prepared by the C.I.O.S.

1-26. Solution of Cassiterite in Alkaline Solutions. V. G. Tronev and A. L. Chrenova. *Reports of the Academy of Sciences of U.S.S.R.,* v. 54, no. 7, 1946, p. 615-617. (In Russian.)

Artificially prepared tin oxide was successfully dissolved in alkaline solution in an autoclave at 200 to 300° C., although the literature reports no success in attempts to dissolve cassiterite. Results may have application to recovery of tin from ore.

1-27. Research in Flotation. Arthur F. Taggart. *American Scientist,* v. 35, Jan. 1947, p. 85-94.

The development of flotation techniques. Importance of the development of techniques for analysis of dilute solutions and for detection of contaminants by contact-angle measurement. 11 ref.

1-28. Ore Concentration and Milling. E. H. Rose. *Mining and Metallurgy,* v. 28, Feb. 1947, p. 67-72.

1946 developments. Greater utilization of gravity methods for finer sizes seen in current practice.

1-29. Research Widens Field for Iron-Ore Beneficiation. Grover J. Holt. *Engineering and Mining Journal,* v. 148, Feb. 1947, p. 108-111.

1946 developments.

1-30. Concrete Flotation Cells Replace Wooden Ones. *Engineering and Mining Journal,* v. 148, Feb. 1947, p. 122.

Construction of cells built because of timber shortage for use in mill of McIntyre-Porcupine Mines, Ltd., Schumacher, Ont.

1-31. The Roasting Plant, Que Que, Southern Rhodesia, Africa. T. S. Cleary. *Deco Trefoil,* v. 11, Jan-Feb. 1947, p. 5-12.

Details of gold-concentrate treating plant, including roasting, concentration, amalgamation, grinding, cyanidation. Pictures, flow sheets and table.

1-32. Successful Tailing Reclamation. *Mining World,* v. 9, Feb. 1947, p. 29-32.

Flotation and heavy media processes for recovery of lead and zinc from old jig tailings in Coeur d'Alene section of Idaho.

For additional annotations indexed in other sections, see:

26-25-26-31-32-33.

2 SMELTING AND REFINING

2-12. Theoretical Thermal Studies of Steel Ingot Solidification. Victor Paschkis. *Industrial Heating,* v. 14, Jan. 1947, p. 70-72, 74.

Time required to cool the steel from the pouring temperature to any given and desired low temperature.

2-13. Electrolytic Lithium. *Chemical Age,* v. 56, Jan. 4, 1947, p. 19.

Equipment and operations used in a German plant to collect lithium which analyzes 97% purity.

2-14. Pilot-Plant Investigations—Production of Sponge Iron With Producer Gas. D. R. Torgeson, T. E. Evans, and R. G. Knickerbocker. *Bureau of Mines Report of Investigations* 3994, Dec. 1946, 42 p.

Producer-gas reduction of fine ores was evaluated in a Skinner multiple-hearth furnace. Results showed that fine ores can be reduced satisfactorily by producer gas at temperatures between 850 and 950° C. Gas-utilization efficiencies were comparatively low. Previous work reviewed, experimental work and results presented in detail. 17 ref.

2-15. Electrolytic Cobalt—A Commercially Feasible Process. F. K. Shelton, Ruth E. Churchward, J. C. Stahl and C. W. Davis. *Electrochemical Society Preprint* 91-4, 1947, 71 p.

Method of electrowinning cobalt from cobaltite ores. Process comprises roasting the ore, extracting the arsenates from the calcine by a caustic leach, extracting the cobalt from the residual solids in an acid leach, purifying the leach solution, preparing cobalt carbonate from the purified solution, and finally electrodepositing metallic cobalt from a $CoSO_4$ electrolyte at 60° C. in a cyclic operation in which the cobalt carbonate is used to neutralize the acid electrolyte. Data for the estimation and design of a commercial plant, and alternative procedures for different economic and technical conditions.

2-16. The Mechanism of the Carbon-Oxygen Reaction in Steelmaking. C. E. Sims. *Metals Technology,* v. 14, Jan. 1947, T. P. 2129, 14 p.

The physical chemistry of reaction with major emphasis on the mechanisms involved; relates these mechanisms to recently published data. 11 ref.

2-17. Nonferrous Metallurgists Cut Costs and Slag Losses. Carle R. Hayward. *Engineering and Mining Journal,* v. 148, Feb. 1947, p. 112-114.

Possible improvements in copper casting. Copper slag washing.

2-18. Use of Oxygen in the Openhearth Bath. G. V. Slottman and F. B. Lounsberry. *Iron Age,* v. 159, Feb. 20, 1947, p. 42-45.

Preliminary report on the first large-scale application of oxygen to an open-hearth furnace bath. Operating technique.

2-19. Acid Electric Melting. Norman F. Dufty. *British Steelmaker,* v. 13, Feb. 1947, p. 80-86.

Advantages and disadvantages of refractories; charging and melting; oxidizing; slag control; deoxidation.

2-20. Metallurgy of Lead. A. D. Turnbull. *Mining and Metallurgy,* v. 28, Feb. 1947, p. 61-62.

1946 developments in recovery of lead, such as those in direct smelting, in the improvement of sintering, and in the further mechanization of refineries.

2-21. Zinc Metallurgy. W. M. Peirce. *Mining and Metallurgy,* v. 28, Feb. 1947, p. 66.

1946 developments in recovery of zinc; plant expansions and labor-saving devices.

For additional annotations indexed in other sections, see:

10-19-20; **12**-24; **14**-50; **25**-14-15-16-22-24-25; **26**-22; **27**-44.

(Turn to page 18)

Bayless Celebrates Silver Anniversary Of Service With National Society

A quarter-century of service to the American Society for Metals was marked by Ray T. Bayless on March 1, 1947.

Since joining the headquarters staff of the then American Society for Steel Treating 25 years ago, as first full-time editor of the *Transactions*, Mr. Bayless has helped the society grow from a small organization of some 3000 members and 30 chapters to its present total of 20,000 members in 71 chapters. During the same time he has helped to expand immeasurably the extent, variety and value of the services rendered to the members.

Mr. Bayless has continued as editor of the *Transactions* through the years and also as secretary of the Publications Committee; in this capacity he is in charge of scheduling the papers and arranging the program for the annual conventions of the society and for the continuing smooth and efficient running of the technical sessions.

It is at these sessions that the largest number of A.S.M. members have become acquainted with Ray Bayless as the busy man who sees that speakers, chairmen, projectors, lights, and public address system all function properly and promptly in three or four simultaneous meetings. Few, however, are cognizant of the many other duties he performs in the national office.

In 1930 he was appointed assistant secretary of the society in charge of all technical and educational activities, and has been secretary of the society's national Educational Committee since its establishment. Likewise in 1930 he was named editor of *The Review* (predecessor of *Metals Review*), which was founded in that year, as was also the monthly magazine *Metal Progress*. In January 1947 his title was changed from editor to publishing director of *Metals Review*.

While finding time to edit over 35 technical books published by the society, Mr. Bayless has also taken on a heavy executive load in the supervision of the society's extensive publishing activities, and a large part of the management of the national office. Purchasing agent, office manager, personnel director — these and a number of other titles could well be added to the many he carries officially.

Mr. Bayless was graduated from University of Michigan in 1914 with a degree of Bachelor of Chemical Engineering, majoring in metallurgy. He was briefly employed by the Michigan

Ray T. Bayless
Assistant Secretary

Smelting and Refining Co. and General Motors Research Laboratories before becoming assistant chief metallurgist and chemist for Chalmers Motor Co., Detroit. During World War I (1917) he came to Cleveland as supervisor of tests in the Ordnance Department, Cleveland District. From 1920 to 1922 he was metallurgical engineer for the James H. Herron Co., Cleveland, joining the American Society for Steel Treating in March 1922. Since then he has grown with the society.

W. H. Eisenman

Films on Broaching Offered

Two sound color films on broaching are offered for showing to A.S.M. chapters by Fred F. Sleeper, 16 Post Rd., Marlboro, Mass. Mr. Sleeper, who is assistant chief engineer and lecturer for the Lapointe Machine Tool Co., Hudson, Mass., is also prepared to give a brief talk on this subject.

Shepherd Describes P-V Test in Stoughton Lecture

Reported by R. J. Thomas
Chief Metallurgist
Jacobs Aircraft Engine Co.

In introducing B. F. Shepherd, chief metallurgist of Ingersoll Rand Co., and past national president, as the featured speaker at the annual Bradley Stoughton Night of the Lehigh Valley Chapter, Chairman A. L. Crobaugh described him as "a scientist who is primarily interested in obtaining a practical industrial application for his scientific discoveries". Mr. Crobaugh then presented the annual Stoughton Award to Mr. Shepherd.

Mr. Shepherd's lecture was a continuation of his discussion of "hardenability" and its method of determination which he first presented in 1930. The need for a test to determine the hardenability of carbon toolsteel having extremely high cooling speeds, and a test procedure that could be conducted with minimum expense, resulted in the development of the P-V test. A color movie vividly emphasized the simplicity and reproducibility of this test.

Compliments

To **Francis M. Walters, Jr.**, on receiving the Distinguished Civilian Service Award of the U. S. Navy for his work as assistant superintendent and later as superintendent, metallurgy division, Naval Research Laboratory, Washington, D. C., where he made outstanding contributions to the fields of welding, steel casting and nonferrous alloys, and devised a method of calculating tensile strength of normalized steels.

To **Joseph W. Ludewig**, now associate professor of metallurgical engineering, College of Engineering and Science, Carnegie Institute of Technology, on his promotion to rank of rear admiral upon retirement from the U. S. Navy.

To **Max Kuniansky**, vice-president and general manager, Lynchburg Foundry Co., Lynchburg, Va., on his nomination for president of the American Foundrymen's Association for 1947-48, and to **William B. Wallis**, president of the Pittsburgh Lectromelt Furnace Corp., on his nomination for vice-president. To **E. N. Delahunt**, general superintendent of Warden King, Ltd., Montreal, and **Russell H. McCarroll**, director of chemical and metallurgical engineering and research, Ford Motor Co., on nomination to the A.F.A. board of directors.

To **George N. Sieger**, president of S-M-S Corp., Detroit, on his election to the presidency of the Resistance Welder Manufacturers Association.

To **Henry A. Mullen**, manager of the resistance welding division, Ampco Metal, Inc., on his election as chairman of the alloy group of the Resistance Welder Manufacturers Association.

To **Harry B. Osborn, Jr.**, sales manager, Tocco Division, Ohio Crankshaft Co., Cleveland, on being named "outstanding young man of the year" by the Cleveland Junior Chamber of of Commerce, and being presented the 1946 Distinguished Service Award.

Payson Is St. Louis Speaker

Reported by Louis Malpoker
Foreman, Lincoln Engineering Co.

Peter Payson, assistant director of research for Crucible Steel Co. of America, was the featured speaker at the January meeting of the St. Louis Chapter. He spoke on "Annealing of Steel", a talk that has been reported in previous issues of *Metals Review*.

A dinner preceded the meeting, accompanied by historical pictures of some outstanding games of football, and a short history of the game.

3 PROPERTIES OF METALS AND ALLOYS

3-24. Hot Shortness of the Aluminum-Silicon Alloys of Commercial Purity. A. R. E. Singer and P. H. Jennings. *Journal of the Institute of Metals,* v. 73, Dec. 1946, p. 197-212.

Hot shortness of the commercially pure aluminum-silicon alloys was studied by means of casting and welding experiments. Under the conditions of casting used, the severity of cracking of the alloys increases with increasing silicon content to a maximum at approximately 0.7% and then decreases to zero with alloys containing about 3% silicon. In welding experiments, the maximum amount of cracking was found to occur at a composition of approximately 0.8% silicon, the severity of cracking then decreasing to a low value as before.

3-25. A Note on the Influence of Additions of Thorium to Magnesium-Base Alloys. F. A. Fox. *Journal of the Institute of Metals,* v. 73, Dec. 1946, p. 223-228.

A rough, exploratory examination of the effects of additions of thorium on magnesium and on two magnesium-base alloys indicates that, although it resembles zirconium, additions of thorium to magnesium do not produce the grain-refining effects caused by zirconium. Up to about 1.2% thorium can be introduced into magnesium-zinc alloys, but the alloys are weak and show intercrystalline fractures. Thorium will not alloy with magnesium alloys containing aluminum, but it has some effect in reducing the iron content of such alloys.

3-26. Stability of Steels. A. B. Wilder and J. D. Tyson. *Western Metals,* v. 5, Jan. 1947, p. 13, 57.

The grades or chemical compositions of steels which afford greatest resistance to graphitization with retention of favorable creep-rupture characteristics.

3-27. Gas Porosity in Aluminum Alloys. Hiram Brown. *Foundry,* v. 75, Feb. 1947, p. 88, 199, 200, 203, 206, 208, 210, 212, 214.

Chief, if not only, cause is presence of hydrogen in the metal. This is brought about by hydrogen pickup from products of combustion, from water and oil, from inclusion of various alloys. Precautions which will help avoid gas porosity and degassing methods. (Presented at A.F.A. Regional Foundry Conference, Chicago, Nov. 21-22, 1946.)

3-28. Cast Irons. William F. Chubb. *Iron and Steel,* v. 20, Jan. 1947, p. 19-22.

Thermal stability of some chromium-nickel-copper alloys was investigated in an attempt to develop an alloy for chill-cast iron rolls which would not require prolonged heat treatment for surface hardness above Brinell 550. However, all of the combinations tried lost hardness rapidly during the short-cycle heat treatment required to improve the properties of the internal portions of the roll.

3-29. New Strong Aluminum Casting Alloy. Harold Knight. *Materials & Methods,* v. 25, Jan. 1947, p. 68-71.

Properties and applications of new 11% Mg aluminum alloy. Addition of fractional percentages of beryllium and boron, and use of special techniques during melting and casting have resulted in considerable increase in tensile strength, impact strength, elongation, and high corrosion resistance. It is heat treatable, and the values given are those reached in the fully heat treated and aged condition.

3-30. New 9% Nickel Steel Tubing—Properties and Processing. H. D. Newell, J. A. Manfre and M. A. Cordovi. *Materials & Methods,* v. 25, Jan. 1947, p. 62-67, 159.

Its mechanical and working characteristics, its heat treating behavior and its weldability. Suggests fields of application.

3-31. Thermal Properties of Metals. *Materials & Methods,* v. 25, Jan. 1947, p. 123.

Table gives specific heats, melting points, heats in solid and liquid at melting points, latent heats of fusion, average pouring temperatures, and heats in liquid at pouring temperature of 45 metals and alloys.

3-32. Aluminum-Magnesium Alloys. F. Santini and J. Herenguel. *Metal Industry,* v. 70, Jan. 24, 1947, p. 63-64.

The "swelling" defect in the welding of worked products of the Al-Mg alloy group is due to the presence of pre-existing gaps, breaks or flaws in the alloy. (From *Revue de l'Aluminium.*)

3-33. The Development of a Turbo-supercharger Bucket Alloy. E. Epremian. *Canadian Metals & Metallurgical Industries,* v. 10, Jan. 1947, p. 22-25, 31.

Experimental data obtained in the development of a cobalt-base alloy for turbosupercharger bucket application. (Paper presented to American Society for Metals, November 1946.)

3-34. Notch Sensitivity of Metals. M. S. Paterson. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 19,* Dec. 1946, 26 p.

Reviews published articles on notch sensitivity in fatigue of metals. Sources of stress concentration and suggested measures of their effects in fatigue. Theoretical aspects of notch effects which include many attempts to explain the discrepancy between the theoretical stress concentration factor and the observed strength reduction factor. Influence of many physical and mechanical factors on notch sensitivity.

3-35. The Failure of Metals by Fatigue. J. Neill Greenwood. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 1,* Dec. 1946, 6 p.

After a brief historical survey, the physical features of a fatigue failure are described. Variables controlling fatigue failure are the relationship between magnitude of stress and number of cycles, the presence of stress concentration, the influence of repeated stress below and above the fatigue limit. The various types of stress concentrators are listed.

3-36. Theories of the Mechanism of Fatigue Failure. W. Boas. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 3,* Dec. 1946, 9 p.

Experiments carried out on metallic single crystals; those using X-ray diffraction methods show that failure by fatigue is merely a special case of failure under all forms of stressing actions and not a special problem of its own, and it must be considered as a consequence of slip. Deformation is localized in the immediate neighborhood of the fatigue fracture where it reaches a critical amount. It is the total strain which has a certain characteristic value at fracture. Recent theories of the mechanism of fatigue failure.

3-37. Fatigue of Bolts and Studs. J. G. Ritchie. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 17,* Dec. 1946, 26 p.

Reviews published information relating to the fatigue of bolts, studs and nuts. Subject is covered in seven sections, namely: the thread in its various standard forms; type of material; method of manufacture, showing the superiority of the thread rolling process; surface condition and treatment, such as hardening, shot-peening or plating; design of bolts and studs; design of nuts; and finally the assembly process showing the effect of correct prestressing and how it is obtained.

3-38. The Fatigue of Welded Steel Tubing in Aircraft Structures. C. J. Osborn. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 18,* Dec. 1946, 17 p.

Briefly reviews literature concerned with fatigue in tubular steel aircraft structures. Various types of welded specimens used in fatigue tests in attempts to approximate service conditions indicate that joint design is probably the most important single factor affecting fatigue strength. The effects of chemical composition, welding technique, heat treatment, etc., on the fatigue strength of welded joints in steel tubing have also been investigated. The magnitude of fluctuating stresses in aircraft components is discussed and the problem illustrated by some examples of service failures.

3-39. Composition and Physical Properties of Steel in Relation to Fatigue. D. O. Morris. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 20,* Dec. 1946, 20 p.

Relation of the various physical properties and effect of the individual constituents of steels on fatigue properties. Critical treatment is given of the relation of notched impact test to fatigue properties. Attention is drawn to the fact that phosphorus tends to increase the fatigue limit as do carbon, manganese, nickel, and chromium. The opinion is expressed that sulphur up to at least 0.10% does not appreciably affect the fatigue properties of steels, either longitudinally or transversely, and experimental work carried out on high-sulphur free-cutting steels supports this belief.

3-40. Failures of Railway Materials by Fatigue. Hugh O'Neill. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 24,* Dec. 1946, 8 p.

Type of fatigue failure in rails, tires, wheelcenters, axles, fireboxes and staybolts with reference to the accelerating effect of corrosion and also to the incidence of fatigue cracks in materials under compression. Instances of fatigue failure of parts in transit.

3-41. The Influence of Radial Pressure From a Press Fit on the Endurance Limit of Axles and Crank Pins. G. W. C. Hirst. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 25,* Dec. 1946, 9 p.

Work done since 1936 on the fatigue failure of axles and its relation to press fits by members of the staff of Redfern Laboratory of the N. S. W. Railways. Evolution of opinion regarding the cause of fatigue cracking in the wheel seats of railway axles is traced from the "notch effect" theory advanced by Kuhnel to the later theory based on the presence of induced tensile stresses at the surface and fretting corrosion at the mating surfaces. Possibility of employing cast iron wheelcenters as a means of minimizing fretting corrosion.

3-42. Fatigue Failure of Axles of Car and Wagon Railway Rolling Stock. E. Connor. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 26,* Dec. 1946, 8 p.

Failure of those portions of the axles carrying the wheels. Methods of detecting the presence of cracks hidden by the wheel boss; conclusion reached is that removal of the wheel is still the only positive means of doing this. Various possible modifications in design, material and finish, that might help to minimize the incidence of fatigue cracking in axle wheel seats. Precautions that may diminish the frequency of fatigue cracking.

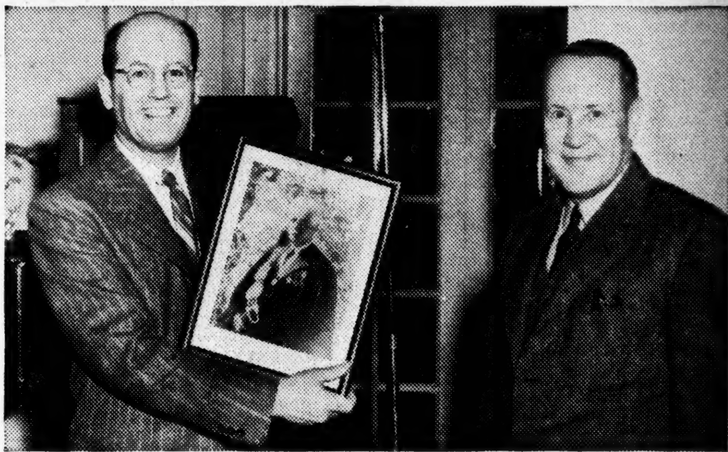
3-43. Types of Fatigue Failure in the Steel Industry. W. O. Beale. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 27,* Dec. 1946, 7 p.

Fatigue failures met with in the heavy steel industry classified according to apparent cause and location:

(Turn to page 20)

Double and Triple Tempering of Toolsteel Explained by Cohen in Sauveur Lecture

Reported by Dow M. Robinson
New England Metallurgical Corp.



Morris Cohen (Left) Holds the Sauveur Award Presented to Him by V. O. Homerberg (Right) on Behalf of the Boston Chapter

Every year the memory of Prof. Albert Sauveur is honored by the Boston Chapter ⊜ on Sauveur Night. For this event a speaker is chosen who is qualified to present some outstanding contribution in the realm of metallurgy in which he has been actively engaged. The Sauveur Night Speakers Committee, under the able chairmanship of V. O. Homerberg, selected Morris Cohen, professor of metallurgy at Massachusetts Institute of Technology, for this distinguished honor.

Dr. Cohen introduced his subject, "The Tempering of Toolsteels", by surveying briefly the principles of hardening. He used 18-4-1 high speed steel austenized at 2350° F., as an example. Here we find that the austenite may transform on cooling at the high temperature of 1200 to 1400° F., resulting in an aggregate of ferrite and carbide, called "pearlite" if the carbide is platelike, and "spheroidite" if the carbide is rounded. However, when the cooling is too rapid for the austenite to decompose in this temperature range, the transformation may occur at about 500 to 700° F., and the decomposition product is "bainite". The true hardening of toolsteel takes place below 450° F. and the decomposition product is "martensite", which starts forming at the Ms point, and at room temperature the 18-4-1 steel ends up with 80% martensite and 20% retained austenite.

Retained austenite is present in varying amounts in plain carbon, low-alloy oil hardening, and high-alloy air hardening toolsteels. The retained austenite decomposes slightly at room temperature and is a factor to be considered in dimensional instability, causing trouble in precision parts. Tempering must provide a balanced combination of strength, toughness and dimensional stability, without undue loss of hardness.

Some Austenite Remains

The various stages of tempering in plain carbon and low-alloy steels depend on both temperature and time. Unlike in high speed steel, the retained austenite in the lower alloy steels decomposes in the range of 400 to 600° F. However, tempering in this range usually causes too much softening for tool purposes. Therefore, most low-alloy toolsteels contain austenite even after tempering. This austenite is not as detrimental as in the quenched steel because the tempering seems to stabilize the austenite that remains.

It is now an old story that double tempering is beneficial to high speed steel, and of course the reason is that the transformation takes place on cooling from the draw, producing a batch of new and untempered martensite, and also setting up new stresses because of the volume changes that occur in the hard steel at relatively low temperatures. If we adjust the first tempering at 1050° F. to convert all the austenite, then the second temper merely becomes a stress-relieving and toughening operation, there being no more martensite formed on cooling from the second draw. Less than one Rockwell C point in hardness is lost by double tempering. Even this loss may be eliminated by using 950 instead of 1050° F. for the second temper.

Triple Tempering Justified

Triple tempering of high speed steel is justified in some instances. For example, when the hardening quench is arrested above room temperature (as is sometimes done to avoid quenching cracks) the austenite-martensite transformation is stopped prematurely and as a result a large amount of austenite goes into the tempering treatment. Under these circumstances, two tempers are necessary to convert the retained austenite and a third draw is utilized to relieve the untempered martensite formed on cooling from the second tempering.

In summarizing, Dr. Cohen demonstrated the quantitative relationship of tempering temperature and time by plotting the changes in hardness against the combination of temperature and time proposed by the Hollomon-Jaffe parameter.

He also explained the martensite and carbide transformations during tempering, and conducted a brief excursion into atomic structure by reviewing the results of an X-ray study, shown on slides, which depicted the structural changes versus tempering temperature. The slides and graphs prepared by the speaker and his students were exceptionally clear and understandable.

Metallurgist Must Educate Designers McQuaid Preaches

Reported by J. D. McNair
Plant Metallurgist
Indiana Steel and Wire Co.

Taking the metallurgists to task for failing to act as professionals rather than as journeymen, Harry W. McQuaid presented a quasi sermon on the subject of "Effect of Stresses on Machine Design" before the Muncie Chapter ⊜.

The designer, with very little correct information on materials, stress concentrations and effects of heat treatment, makes many errors, he said. When trouble occurs the metallurgist is called in to correct the heat treatment, replace the steel with a better one, or suggest some other cure. If he says the design is poor and at fault, he is credited with "passing the buck".

The metallurgist must educate the designers to correct utilization of materials, avoidance of stress concentrations, and anticipation of trouble in heat treatment. He should be consulted in advance when designs are contemplated and not be just the last resort after trouble occurs. Only then will he attain full professional stature.

Various examples of good design and poor design, along with solutions or countermeasures, were illustrated by slides.

Any product should be just good enough for the job it must do, Mr. McQuaid philosophized. If it is far better than necessary, someone's money is being wasted. If it is not good enough, someone's job is in jeopardy.

the relative frequencies are given. Corrective measures used to eliminate the failures are indicated.

3-44. Some Practical Aspects of Wire Fatigue in Aerial Telephone Lines Based on an Analysis of Wire Breakages. D. O'Donnell and A. S. Bundle. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 28,* Dec. 1946, 9 p.

Wire breakages analyzed during 6 mo. over some 30,600 wire miles of telephone lines on selected routes. Extent of wire fatigue and incidence of such faults in relation to points of failure; construction features of the joints and terminations where failures occur.

3-45. The Vibration of Telephone Line Wires. H. C. Levey and P. R. Brett. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 29,* Dec. 1946, 20 p.

Method of approach and results so far obtained in determination of the frequency of vibration of an experimental line wire and the wind velocities causing these vibrations.

3-46. Fatigue Failures of Lead Sheathing of Telephone Cables. S. D. Chivers. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 30,* Dec. 1946, 4 p.

Types of faults usually found together with some other classes of faults showing a similar appearance. Adoption of mitigative measures.

3-47. Magnetostriction of Transformer Steel Subjected to Thermomagnetic Treatment. J. Shur and A. Khokhlov. *Journal of Physics* (U.S.S.R.), v. 10, no. 6, 1946, p. 540-542. (In English.)

Thermomagnetic treatment of ferromagnetic material consists in cooling in the presence of an external magnetic field from some temperature above the Curie point to room temperature. This sometimes results in production of magnetic anisotropy. Magnetostriction curves of a polycrystalline transformer steel, before and after such a treatment. Comparison of the curves shows that a strongly pronounced magnetic texture is produced by the treatment.

3-48. Rate of Oxidation of High-Chromium Iron-Chromium-Aluminum Alloys. I. I. Kornilov and A. I. Spikelmann. *Reports of the Academy of Sciences of U.S.S.R.,* v. 53, Sept. 21, 1946, p. 813-816. (In Russian.)

The oxidation process at high temperatures is assumed to consist of: first, oxidation of the three components; and second, diffusion of aluminum on the surface of the alloy. To aid in development of high temperature alloys, a series of high-chromium alloys was investigated for chemical constitution, weight loss, and changes in electrical properties, after 1000 hr. at 1200° C. Results are presented in chart form. The most heat resistant combinations found were: 25% Cr, 7 to 10% Al; and 40% Cr, 10 to 13% Al.

3-49. Hardness Curve of Nickel-Copper Alloys. K. A. Osipov. *Reports of the Academy of Sciences of U.S.S.R.,* v. 53, Sept. 21, 1946, p. 821-823. (In Russian.)

Maximum hardness of Ni-Cu alloys was found to occur at about 60 atomic % (62 wt. %) Cu. A theory is presented which explains the shape of the hardness curve and the location of its maximum point in terms of atomic structure.

3-50. Rate of Oxidation of Chromium-Nickel-Iron Austenitic Alloys. I. I. Kornilov and A. I. Spikelmann. *Reports of the Academy of Sciences of U.S.S.R.,* v. 54, Nov. 21, 1946, p. 515-518. (In Russian.)

Ferritic and austenitic heat resistant alloys, having iron as base metal, are oxidized at elevated temperatures mainly on account of presence of an easily oxidized element. Experimental results show this element to be aluminum in ferritic chromium-aluminum alloys. In austenitic chromium-nickel alloys containing carbon and silicon, carbon, silicon and chromium are all oxidized readily up to 1100 to 1150° C. Above 1200° C., only carbon and silicon are affected appreciably.

3-51. Which Cast Steel? Part III. Influences of Processing Operations. E. J. Wellauer. *Machine Design,* v. 19, Feb. 1947, p. 138-142.

An investigation of the factors which relate to processing operations, particularly welding and machining; economic considerations in specification and design.

3-52. Variation Thermique de l'Animantation Spontanée. (Thermal Variation of Spontaneous Magnetization.) Charles Guillaud. *Comptes Rendus,* v. 223, Dec. 23, 1946, p. 1110-1112.

Hypothesis that all ferromagnetic bodies may acquire a definite magnetization called spontaneous magnetization in the absence of an exterior field only by the influence of a molecular field is experimentally confirmed.

3-53. The Flow of Metals at Elevated Temperatures. Part I. J. H. Hollomon and J. D. Lubahn. *General Electric Review,* v. 50, Feb. 1947, p. 28-32.

A general relation for the combined effects of three variables on the stress required for plastic flow. Applicability of the general relation to a wide variety and range of conditions. (To be continued.)

3-54. Tool Steels. Part II. L. Sanderson. *British Steelmaker,* v. 13, Feb. 1947, p. 90-93.

Properties of hot working steels, die steels and shock resistant steels. (To be continued.)

For additional annotations indexed in other sections, see:
4-9; **5**-10; **9**-7-16-24-25-27-28; **14**-38; **19**-35-47-53; **23**-23-35-50; **24**-42-48; **25**-13-14-15-16.

4 STRUCTURE — Metallography & Constitution

4-8. Sur une Double Structure de l'Acier. (Concerning a Double Crystal Structure in Steel.) L. Colombier. *Comptes Rendus,* v. 223, Dec. 9, 1946, p. 999-1001.

A hypothesis consisting of an assumption that in any steel there is present a superposition of two crystal structures. The metal may be of martensite, sorbite, or troostite structure, but superposed on this structure there is said to be a structure of different composition, which is determined by the former austenitic structure.

4-9. The Mechanical Properties of Metallic Solid Solutions. F. R. N. Nabarro. *Proceedings of the Physical Society,* v. 58, Nov. 1, 1946, p. 669-676.

The theoretical relation between lattice strains produced by precipitation in a metal and the corresponding increase in hardness is extended to lattice strains in metallic solid solutions. The elastic limit of a single crystal of a solid solution is calculated on the assumption that the crystal will slip when the applied external stress is equal to the mean value of the internal stress. Similar considerations are applied to the hardness of polycrystalline solid solutions. The theory is extended to cases in which the increase of hardness produced by alloying is not large in comparison with the hardness of the pure solvent. 27 ref.

4-10. Etude de la Recristallisation du Zinc. (Study of Zinc Recrystallization.) C. Crussard and F. Aubertin. *Metaux et Corrosion,* v. 21, April 1946, p. 45-53.

Evolution of nuclei and new crystals during the process of recrystallization and factors causing their formation and growth.

4-11. The Structure of Real Crystals. Kathleen Lonsdale. *Science Progress,* v. 35, Jan. 1947, p. 1-11.

A critical review. Many references throughout the text.

4-12. Investigation of the Ternary System Copper-Nickel-Lead. V. A. Nemilov and I. A. Stemina. *Journal of Applied Chemistry (U.S.S.R.),* v. 19, no. 5 and 6, 1946, p. 449-460. (In Russian.)

Results of an investigation of five sections of the system. They were obtained by tests and by thermal microstructure analysis. 15 ref.

4-13. Summarized Proceedings of Conference on X-Ray Analysis, London, 1946. *Journal of Scientific Instruments,* v. 24, Jan. 1947, p. 1-21.

Summaries of some of the papers presented by scientists and crystallographers from each of the following countries: Belgium, Czechoslovakia, Finland, France, Germany, Austria, Great Britain, Holland, India, Norway, Sweden, United States, and Russia. Discussions. 218 ref.

4-14. Metal Electrons and Catalysis. George-Maria Schwab. *Transactions of the Faraday Society,* v. 42, Nov. 1946, p. 689-697.

A new method for measurement of temperature coefficients of formic acid dehydrogenation with alloy catalysts is described and applied to homogeneous and heterogeneous alloys of silver, gold and copper with other metals. Relation to modern theories of the atomic structure of metals, especially those of Hume-Rothery.

4-15. Carbide Structures in Carburized Thoriated Tungsten Filaments. C. W. Horsting. *Journal of Applied Physics,* v. 18, Jan. 1947, p. 95-102.

A wide variety of carbide structures was found in the surface layer of these filaments. Their origin was traced to carburizing conditions and subsequent processing. A frequently occurring laminated structure was found to contain less carbon than W_2C. The thyratron-relay method of carburizing control is critically reviewed. Abnormal filament current in manufactured tubes is believed to be caused by surface conditions which cause changes in thermal emissivity.

4-16. The Effect of Supersonic Waves on the Solidification of Molten Metals. S. Sokoloff. *Ministry of Aircraft Production R.T.P. Translation No. 2568,* 4 p.

Effect of supersonic waves on crystallization of zinc with emphasis on rate of formation and growth of crystals and nature of the growth. Apparatus and technique used. Micrographs and macrographs show structure before and after exposure. Supersonic exposure results in a more dendritic structure. (From report issued by the Electro-Technical Institute, Leningrad.)

4-17. Etude de la Recristallisation du Zinc. (Study of Zinc Recrystallization.) Parts IV and V. (Concluded.) C. Crussard and F. Aubertin. *Métaux et Corrosion,* v. 21, May 1946, p. 66-72.

Results of Mehl's research on recrystallization of aluminum are compared with those obtained by the authors with zinc. Dependence of grain growth of zinc on temperature was found to be similar to that of aluminum; the most favorable temperature was around 250° C.

4-18. Interpretation Métallographique de l'Instabilité des Ferronickels Réversibles. (Metallographic Interpretation of the Reversible Instability of Ferronickels.) P. Chevenard. *Comptes Rendus,* v. 223, Dec. 23, 1946, p. 1073-1076.

A metallographic study of the instability of iron-nickel alloys. To minimize instability, it is recommended that less than 0.05% carbon be used, that titanium or vanadium be added

(Turn to page 22)

Fisher Body Engineer Speaks on Die Design

Charles R. Cory of Fisher Body Division (Left) Was Principal Speaker at the December Meeting of West Michigan Chapter. Center is George Hamp of General Motors; Right is Lou J. Haga of State Heat Treat, Inc.

Reported by Ray E. Cross
Chief Metallurgist, Michigan Light Alloys

"Die Design" was the subject presented by Charles R. Cory, engineer in charge of processing and designing for the Detroit Division of Fisher Body, General Motors Corp., at a recent West Michigan Chapter meeting.

Starting with the design of solid form dies, Mr. Cory pointed out the advantages and limitations of one and two-way pressure pad form dies; pierce, cutoff and form dies; draw dies, and trim dies. Automatic feed for coil stock and other types of automatic loading and unloading devices should be considered for high-production parts.

Use of Draw Dies

Draw dies are only used for forming parts too difficult to be produced in any type of a form die, since the use of a draw die usually requires more metal stock and also the use of a trim die following the drawing operation. One of the techniques in the design of draw dies is to keep the metal in tension to prevent "wrinkles" and the die must be so designed that the metal area increases during the drawing process. Draw dies may operate in a single-action press using spring or air pressure, or in a double-action press, depending on how much blank-holder pressure is required for a successful draw. Draw beads may be used to permit the use of less blank-holder pressure.

During the drawing process, the metal is stressed above the elastic limit, but below the yield point. It must be always under tension to prevent formation of wrinkles, but not under enough tension to tear the metal. A successful draw operation lies in that range between wrinkles and tears. It can be seen that the designer then has to work to rather close limits.

Progressive dies of as many as 11 stages may be used, each stage representing a distinct operation. Such a die is generally fed automatically from coil stock.

Use of Cr Steel Considered As Conservation Measure

Reported by Kenneth P. Borror
Metallurgical Department
Spicer Mfg. Div. of Dana Corp.

An early obstacle to the production of stainless steels was the lack of a low cost ferrochromium that would maintain a low carbon concentration in the finished product, according to Russell Franks of the technical service and development department of Electro Metallurgical Co., in addressing the Toledo Group ⊕. This was overcome by the development of the less expensive, silicon-reduced ferrochromium to replace that originally made by the Goldschmidt process using aluminum.

Certain inherent weaknesses in the stainless steels were largely overcome by the addition of other elements, such as molybdenum to increase resistance to corrosion from chlorides, and columbium and titanium to prevent intergranular corrosion, Mr. Franks explained.

Mr. Franks discussed the feasibility of conserving our available iron ore supplies by using low-alloy stainless steels containing chromium; this would decrease the rate of deterioration from oxidizing conditions which are so prevalent. He predicted that the development of the gas turbine would create a new field in the stainless steel industry with a substantial increase in the percentage of alloying elements used.

Steel Company Changes Name

With the retirement of George E. Sibbett, the Coulter-Sibbett Steel Co. at Oakland, Calif., is now known as Coulter Steel & Forge Co., Emeryville, Calif. The company will continue to market a wide variety of special bar steels and forgings under the direction of James V. Coulter, a past chairman of Golden Gate Chapter ⊕.

Sands Tells How Structure Affects Machining of Steel

Reported by Knox A. Powell
Research Engineer
Minneapolis-Moline Power Implement Co.

Machinability depends mainly on microstructure and very little on chemical composition, John W. Sands told the Northwest Chapter ⊕ at its regular dinner meeting on Feb. 13. Mr. Sands, who is head of the engineering steels section of the development and research division of the International Nickel Co., spoke on the "Effect of Structure on Machining Steels". His lecture was illustrated by lantern slides showing chip formation.

Composition, of course, may affect the production of desirable microstructure, he pointed out. Desirable microstructure is obtained by suitable heat treatment in accordance with the time-temperature-transformation characteristics of a steel. Nickel and other alloying elements may be used to change transformation characteristics in heat treatment in order to obtain the most machinable structure.

Chip formation absorbs energy in three ways—in shearing off the chip, in cold upsetting the chip, and in friction of the chip over the tool face. If the material is hard and strong, it will be difficult to machine on account of shear, while if it has a high elongation and is tough, it will be difficult to machine because of deformation of the chip by cold work.

Cold drawing uses up part of the original percentage elongation of a steel, thus improving its machinability. If a material is soft enough so that friction along the tool face will tear it under the required conditions of speed, feed, tool shape, tool finish, and cutting compound, a built-up edge will form on the tool, producing rough finish.

The characteristics of the soft and hard constituents which make up the microstructure of a steel, and their size and distribution in the structure, determine machinability. Additions of sulphur to form manganese sulphides, and of lead or selenium, may improve machinability by providing chip-breaker slip planes. Alloys in solution in the microconstituents may alter their characteristics.

For steel with over 0.30% carbon, a coarse, spheroidized structure is best for turning, Mr. Sands said, although a lamellar structure is best for milling, drilling and broaching. Combination structures may be chosen for universal machinability, and steel mills can frequently arrange their operations to produce desirable machining structures.

W. Wirt Young Opens New Office

Earl G. Mills ⊕, recently returned from the U. S. Navy, is in charge of the new office of W. Wirt Young & Associates, Inc., at 100 East Lancaster Ave., Wayne, Pa.

to retard the dissolution of cementite during heat treatment, and that the finished products be treated so as to eliminate tendencies toward precipitation.

For additional annotations indexed in other sections, see:
3-36-49; **11**-16-19-20; **14**-47; **25**-19.

5 POWDER METALLURGY

5-8. Some Properties of Engineering Iron Powders. C. J. Leadbeater, L. Northcott, and F. Hargreaves. *Iron and Steel Institute Advance Copy,* Dec. 1946, 24 p.

Properties of 28 commercial iron powders, together with those of compacts prepared from them by simple pressing and sintering technique. The majority of the powders were prepared by either the oxide-reduction or the electrolytic methods but individual samples of the carbonyl, abrasion, and chloride-reduction methods were included. A large number of simple correlation coefficients have been computed for the properties considered. Many factors contribute to the behavior of a powder when it is pressed and sintered, and the properties of the compact are not dependent solely upon any one property of the powder. Among the more important requirements for high tensile strength are small particle size and freedom of the surface of the particles from oxidation.

5-9. Experimentation Plays an Important Role in Work of Yonkers Electro Metal Plant. Joseph G. Cowley and Floyd McKnight. *Modern Industrial Press,* v. 9, Jan. 1947, p. 20, 22, 24, 26.

American Electro Metal Corp.'s laboratory is equipped with copies in miniature of all of the plant's facilities including small presses and sintering furnaces. Pressing and coining methods. Illustrated.

5-10. Some Metallurgical Aspects of Cemented Carbides. John C. Redmond. *Iron Age,* v. 159, Jan. 30, 1947, p. 42-45, 150.

Performance of carbide tools is often as much a matter of the manufacturing technique used as of the chemical composition. Various factors such as grain size and porosity and their effects on physical properties discussed.

5-11. Latest Trends in Powder Metallurgy. W. G. Cass. *Chemical Age,* v. 56, Jan. 4, 1947, p. 5-10.

Historical background; recent developments; thermal decomposition; size of powder grains; inherent cohesive forces; hard refractories; vibration to assist compacting; porous steel skeleton; engine parts; machine tools; vacuum working. 22 ref. (To be continued.)

5-12. Proceedings Second Annual Meeting. *Metal Powder Association,* 1946, 86 p.

Symposium of eight papers was devoted to iron powder metallurgy, except for one paper on sintered tungsten and tungsten alloys and one on furnace atmospheres for sintering. Also includes use of graphite in iron powder compacts; test methods for iron powders; properties of iron powder parts; and a discussion of iron powder costs. Includes discussion of each paper.

5-13. The Effect of Composition on Physical Properties of Tungsten-Copper-Nickel Compacts. Henry H. Hausner. *Powder Metallurgy Bulletin,* v. 2, Jan. 1947, p. 6-11.

Twenty-eight sample compositions were prepared and tested. They varied between approximately 20-80 and 80-20 W-Cu, plus ½ to 1% Ni. Volume change on sintering, electrical conductivity, thickness before and after hot hammering, and Brinell hardness.

5-14. Powder Metallurgy. (Concluded.) W. H. Tait. *Metal Industry,* v. 70, Jan. 17, 1947, p. 43-46.

Modern uses of sintered powder products such as bearings, steel-backed lead-bronze bushes, filters, liners, clutch and brake friction plates, starter brushes, diamond-impregnated cutting tools, and moldable compositions.

5-15. Powder Metallurgy. B. E. Berry. *Metalen,* v. 1, Jan. 1947, p. 77-84. (In English.)

Principles and application of powder metallurgy during the war in England and in other countries.

For additional annotations indexed in other sections, see:
21-15; **22**-89.

6 CORROSION

6-17. Investigations on the Effect of Zinc on the Corrosion of Some Magnesium Casting Alloys. F. A. Fox. *Journal of the Institute of Metals,* v. 73, Dec. 1946, p. 229-241.

Corrosion tests were carried out on unprotected magnesium alloys, with 8 and 9.5% aluminum and varying zinc contents, both in high-purity and in normal-purity material; alloys were immersed in 3% sodium chloride solution and some atmospheric-exposure tests were made.

6-18. Wet and Dry Chlorine Vs. Materials of Chemical Plant Construction. *Chemical Engineering,* v. 54, Jan. 1947, p. 211-212, 214.

Part I of a two-part symposium in which representative manufacturers of corrosion resistant materials discuss the suitability of their products for equipment exposed to wet and dry chlorine gas and chlorine water. Covers lead, high-silicon irons, and chemical porcelain. (To be continued.)

6-19. Results Obtained From Five Years of Cathodic Protection on 24-Inch Gas Line Rapidly Deteriorating From Bacterial Corrosion. Wm. E. Huddleston. *Corrosion,* v. 3, Jan. 1947, p. 1-7.

The line was coated with a commercial tar enamel, but was not wrapped. Results of inspection. Cathodic protection provided excellent results.

6-20. Corrosion Ratings for Metals. H. D. Holler and R. A. Frye. *Corrosion,* v. 3, Jan. 1947, p. 8-21; discussion, p. 22.

Difficulty of providing tables or equations for the prediction of corrosion resistance of metals. Presents tables for various commercial alloys and points out their limitations.

6-21. Resistance of Some Nickel-Containing Alloys to West Texas Crudes. B. B. Morton. *Corrosion,* v. 3, Jan. 1947, p. 23-34.

Recommends high-chromium steels for refining at temperatures above 500° F., and nickel and monel for lower temperature applications in refining, storage, and oil well equipment. Photographs show comparative corrosion results on different metals in actual use.

6-22. Investigation of Electrolytic Corrosion of Steel in Concrete. *Corrosion,* v. 3, Jan. 1947, p. 37-54.

Progress report of Committee on Electrolysis of the Association of American Railroads. Corrosion and current flow in several railroad foundation pedestals and the establishment of a suitable test procedure for determining resistance to ground, amount of current flow, and corrosion of steel embedded in concrete. Appendix describes a study of the effect of electric current on concrete.

6-23. Corrosion of Power Plant Equipment by Water and Steam. Part III. R. C. Ulmer. *Power Plant Engineering,* v. 51, Jan. 1947, p. 108-109, 118.

Corrosion of steam lines, superheaters and condensate lines; corrosion tendencies of wet and dry steam; prevention of corrosion by oxidation. Testing for corrosion in condensate lines; methods for prevention of corrosion in condensate lines give consideration to use of alloys, proper design, use of chemicals and deaeration.

6-24. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry,* v. 39, Jan. 1947, p. 89A-90A.

Extent and importance of the corrosion problem.

6-25. New Technique Combats Electrolysis. R. B. Walter. *Oil Weekly,* v. 124, Feb. 3, 1947, p. 18-21.

A 15-ft. rod on which was strung an alternating series of copper and zinc plates, separated by brass spacers, is installed in corrosive wells in a position to make intimate contact with the oil being pumped. The casing and pump parts are protected against corrosion by the cell couples set up between the copper and the zinc. The "treater units" must be replaced occasionally, when the zinc plates are used up.

6-26. Corrosion of Gas Appliances. *Gas Journal,* v. 249, Jan. 8, 1947, p. 96-98, 101.

Discussion of paper by N. Booth and others, published in the Dec. 11 and 18, 1946, issues.

6-27. Anodic Corrosion of Brass. J. M. Bialosky. *Corrosion and Material Protection,* v. 4, Jan-Feb. 1947, p. 15-16.

Series of experiments performed using muntz metal, naval brass, arsenical muntz and arsenical naval brass with applied anodic current in various aqueous solutions at room temperature to determine the dezincification characteristics of these alloys. Results indicate that arsenical muntz and arsenical naval brass resist this type of attack and naval brass is more resistant than muntz metal under the conditions explored. Initial dezincification occurs in the beta phase and attack of the alpha phase follows. Dezincification reaction produced in tests must have been due to selective attack of the zinc rather than to the redeposition of copper, which would not plate out on the anode of the cells.

6-28. The Corrosion of Metals. Part VI. (Continued.) *Sheet Metal Industries,* v. 24, Jan. 1947, p. 145-151, 153.

Corrosion of copper and its alloys. Resistance of copper-nickel alloys to sea water and marine atmospheres. Effect of high water velocity. Antifouling characteristics, corrosion fatigue, corrosion by steam and condensate of high copper alloys. Effects of oxygen and stress. Effects of various compositions. (To be continued.)

6-29. Corrosion Resistance of 27% Chromium Alloy Recorded High in Plant Service Tests. *Petroleum Processing,* v. 2, Feb. 1947, p. 116-117, 119, 122.

Suggestions for more effective commercial use of 27% chromium-iron alloy by petroleum refiners are given in a report based on 30 metallurgical studies made by several oil companies and the Babcock & Wilcox Tube Co., for the Office of Rubber Reserve. Recommendations for welding and a study of relative behavior and suitability of the alloy for use in catalytic dehydrogenation processes.

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Metallic Thorium And Uranium Exhibited, Described

Reported by Forest E. Allen
Asst. Prof. of Mechanical Engineering
Iowa State College

Metallic thorium and metallic uranium, both of high purity, were exhibited by Harley A. Wilhelm of Iowa State College in connection with his address on "Atomic Energy" before the Des Moines Chapter on Feb. 11. Dr. Wilhelm has been associated with the atomic project for five years and has had direct charge of large-scale uranium production as well as research on project metallurgical work. Processes for the production of both thorium and uranium metals for the Manhattan Project were worked out in the laboratories at Iowa State.

H. A. Wilhelm

Uranium has a density about that of gold and melts in the neighborhood of 2100° F., while thorium, which has a density about that of lead, melts at approximately 3400° F. Much information on the metallurgy of uranium and thorium and their alloys is restricted at this time. The speaker confined his lecture principally to a discussion of atomic energy—what it is, how it operates and some of its possibilities.

Quantitative comparisons of the various forms of ordinary energy were made to show the enormous energy associated with nuclear reactions in the atomic bomb. The speaker illustrated how fissionable materials disintegrate and release energy. The hazards associated with radiations and radioactive products of the atomic reactions were pointed out.

Utilization of heat energy generated in an atomic pile appears feasible for stationary power plants. For power alone, however, the atomic pile cannot economically compete with coal, under normal conditions. In addition to producing useful power, the atomic pile can be used to produce many radioactive isotopes and simultaneously generate more fissionable material that can be used as fuel for atomic piles or atomic bombs.

The radioactive isotopes serve as tagged atoms that can be used in tracer experiments. These isotopes will no doubt find many more applications in biological research and medicine.

Missouri Group Has New Chairman

Harry C. Dameron, currently chairman of the Missouri School of Mines Chapter, has left Rolla and has resigned as chairman of the chapter. Acting chairman is now John E. Schork, 208 West 16th St., Rolla, Mo.

Grimshaw and Kells Talk On Toolsteels at Baltimore

Reported by Russell L. Wilcox
Draftsman, Bethlehem Steel Co.

Colored movies of the atomic bomb tests conducted by the United States Army and Navy at Bikini Atoll in the Pacific opened a joint meeting of the Baltimore Chapter with the American Society of Tool Engineers.

Speaker of the evening was L. C. Grimshaw, chief metallurgist, Latrobe Electric Steel Co. Mr. Grimshaw's talk dealt with the selection of specific types of toolsteels for die work. Many excellent slides were shown illustrating the features of good die design and the utilization of the correct steel.

Following Mr. Grimshaw's talk, many questions were answered by the speaker and by Ray P. Kells, chief service engineer of Latrobe Electric Steel Co., who accompanied Mr. Grimshaw to Baltimore.

Harry W. Dietert Co. Incorporates

The Harry W. Dietert Co. of Detroit is now operating as a Michigan corporation and is extending its research and manufacturing facilities. The research activities will center on the practical application of sand testing equipment in the foundry, using foundry casting tests as the guide.

6-30. The Electrochemistry of Corrosion Fatigue. U. R. Evans. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 8*, Dec. 1946, 7 p.

Recent fundamental work on corrosion fatigue and methods of prevention. The mechanism of stressless corrosion has been quantitatively established by four independent methods. Suggests a mechanism based on the new experimental results.

6-31. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry*, v. 39, Feb. 1947, p. 83A-84A.

Economics of materials for chemical plant construction and desirability of standardizing means of expressing corrosion resistance of materials. Recommends adoption of "mils per year".

6-32. Cathodic Protection of Pipe Lines. E. C. Rogness. *Water & Sewage Works*, v. 94, Jan. 1947, p. 11-13.

Maintenance history of an 8.25-mile, 28-in., riveted steel pipe line, before and after installation of cathodic protection. Partial failure of the system after three years operation led to investigation which resulted in certain changes in the design of the system.

6-33. Corrosion—the Great Destroyer. D. J. Fergus. *Corrosion*, v. 3, Feb. 1947, p. 55-66.

Use of magnesium and magnesium alloy rods for anodic protection of hot water tanks. Comparison of this system with ordinary galvanizing is shown by photographs.

6-34. Use of Sodium Chromate as a Corrosion Control Medium in Gas Condensate Wells. C. K. Eilerts, H. A. Carlson, R. V. Smith, F. G. Archer and V. L. Barr. *Corrosion*, v. 3, Feb. 1947, p. 73-74.

Bureau of Mines research to aid in prevention of corrosion in gas condensate wells has featured two approaches: (1) a search for an inhibitor, and (2) the testing of alloys to find one which would resist this type of corrosion. Among inhibitors, sodium chromate produced the best results.

6-35. Construction and Ratings of Copper Oxide Rectifiers for Cathodic Protection of Pipe Lines. L. W. Burton and C. E. Hamann. *Corrosion*. v. 3, Feb. 1947, p. 75-95.

Operating and application characteristics of the copper oxide cell and the use of copper oxide rectifiers for the prevention of corrosion on pipe lines and similar installations.

6-36. Corrosion Prevention and Protection. F. R. Morral. *Wire and Wire Products*, v. 22, Feb. 1947, p. 133-138, 175.

Various types of corrosion; methods of corrosion testing; corrosion protection; unit operations for coating processes.

6-37. Unusual Cause and Effect of Corrosion. A. H. Stuart. *Petroleum*, v. 10, Feb. 1947, p. 26, 31.

The packing of a centrifugal water pump developed a leak. The graphite impregnated asbestos packing was found to be deteriorated and to contain ferric hydroxide flakes. These were traced to an iron content of over 6% in the natural graphite used. A micaceous hematite, which had been submitted as a graphite substitute, was found to have no lubricating properties.

6-38. Steam Turbine Lubrication Problems and Their Solution. Part 3. Alan Wolf. *Petroleum*, v. 10, Feb. 1947, p. 30-31.

The cooling function of the oil; tube-corrosion problems; use of rust inhibitors. (To be continued.)

6-39. Cathodic Protection. C. H. McRaven. *Petroleum Engineer*, v. 18, Feb. 1947, p. 148, 150, 152, 154.

Theory and technique in pipe-line protection.

6-40. Reactions With Steel of Compounds Containing Chemical Groups Used in Lubricant Additives. Allen S. Powell. *National Advisory Committee for Aeronautics Technical Note No. 1207*, Feb. 1947, 13 p.

Reactions between steel of a type used in aircraft engine cylinder barrels and compounds containing reactive groups commonly found in lubricant additives. Products formed by reaction at temperatures from 400 to 650° F. were analyzed by reflection electron diffraction.

For additional annotations indexed in other sections, see:
3-40-41; 8-13; 25-14; 27-38-43.

7 CLEANING & FINISHING

7-45. The Dyeing of Anodized Aluminum. J. P. Gill. *Journal of the Electrodepositors' Technical Society Reprint*, v. 21, 1946, p. 235-244.

Methods of dyeing anodized aluminum with particular reference to the dyestuffs used, and to the effect of variables on the dyed shade.

7-46. Galvanized Steel Wire. Fred M. Crapo. *Wire and Wire Products*, v. 22, Jan. 1947, p. 31-42.

The development and present status of wire galvanizing processes. 81 ref.

7-47. For Quality, We Chose Modern Finishing Methods. L. A. Brown. *American Machinist*, v. 91, Jan. 30, 1947, p. 77-81.

Reconversion program involved the substitution of automatic spray pickling for the usual vat method; conveyerized porcelain enameling plant; and completely new spray bonderizing unit, air conditioned spray room and equipment for white synthetic enamel.

7-48. Improvements in Tinning. Howard C. Rodgers. *Iron and Steel Engineer*, v. 24, Jan. 1947, p. 65-66.

Advantages of vacuum feeding and electrolytic pickling in the tinning operation.

7-49. Observations on Some Surface Properties of Vitreous Enamels. W. E. Benton. *Foundry Trade Journal*, v. 81, Jan. 2, 1947, p. 11-16.

Problems that connect practical ease of cleaning and satisfactory appearance with the constitution and form of an enamel surface.

7-50. Formation and Application of Phosphate Coatings. Van M. Darsey and Walter R. Cavanagh. *Electrochemical Society Preprint* 91-1, 1947, 14 p.

The evolution of phosphate coating metals; use of metal accelerators and suitable oxidizing agents in the phosphating solution expedited the coating formation and made possible the production of paint base coatings on metals within 2 to 5 min. Combining spray application with such accelerated phosphate solutions containing an oxidizing agent further reduced the coating time to as low as 2 to 10 sec. Application to various metals.

7-51. Problems in Porcelain Enameling Nonenameling Sheets. W. A. Deringer. *Steel Processing*, v. 33, Jan. 1947, p. 26-32.

Structural difference between killed and rimmed steel. The various problems encountered in enameling and their solutions. Contrary to past beliefs, the addition of small amounts of titanium to the steel has been found beneficial for enameling operations. 8 ref.

7-52. Finishes for Magnesium. R. T. Wood. *Aluminum and Magnesium*, v. 3, Jan. 1947, p. 12-14, 17, 22.

Surface preparation and cleaning; treatments used as preparation for painting; paint systems. Some of the comparatively hard, decorative or special purpose coatings made by chemical treatment.

7-53. Influence of Various Additions in the Phosphating of Metals. II. Influence of Additions of Nitrates of the Univalent Metals. I. I. Hain. *Journal of Applied Chemistry (U.S.S.R.)*, v. 19, no. 5 and 6, 1946, p. 527-534. (In Russian.)

Influences on acidity of the phosphating solution, duration of gas formation, structure, color, and corrosion resistance of the coating.

7-54. The Fabrication and Porcelain Enameling of Formed Metal Plumbing Ware. J. W. Sampson and S. E. Hempsteger. *Finish*, v. 4, Feb. 1947, p. 13-16, 30.

Units include bathtubs, lavatories and kitchen sinks in a range of sizes and shapes. Equipment and procedures for pickling and spraying.

7-55. A Visit to Columbus Porcelain Metals Corp. Dana Chase. *Finish*, v. 4, Feb. 1947, p. 28, 52.

Operations at small box furnace jobbing plant.

7-56. High-Temperature Protection for Mild Steels. William N. Harrison, Dwight G. Moore and Joseph C. Richmond. *Steel*, v. 120, Feb. 10, 1947, p. 92-93, 120, 122.

Newly developed ceramic coatings feature high resistance to chipping under repeated thermal shock and protection of metal against oxidation during prolonged exposure to temperatures up to about 1250° F. Refractory properties of ground coat frits tested on aircraft exhaust systems improved with 20% admixture of alumina.

7-57. Lime Treatment of Waste Pickle Liquor. Richard Hoak, Clifford J. Lewis, Charles J. Sindlinger and Bernice Klein. *Industrial and Engineering Chemistry*, v. 39, Feb. 1947, p. 131-135.

Methods for attaining satisfactory results with the less reactive, but more readily available, dolomitic lime.

7-58. New Enameling System. *Steel*, v. 120, Feb. 17, 1947, p. 92-93, 128.

Cuts oven travel-time 50% for Dodge in applying better auto body finishes.

7-59. Special Finishing Installation Eliminates Production Problem. E. L. Verhagen. *Products Finishing*, v. 11, Feb. 1947, p. 70-72.

How specially designed "double-heat" infrared oven, with unusual contour and employing rows of lamps set at criss-cross angles, reduced required baking time from 30 to 8 min. in finishing of wall-type can openers.

7-60. Electropolishing with Fluosulphonic Acid. C. B. F. Young and Kenneth R. Hesse. *Metal Finishing*, v. 45, Feb. 1947, p. 63-67, 84.

Investigation to determine whether or not fluosulphonic acid could be used as an electropolishing agent for stainless steels, plain carbon steels and various nonferrous metals. Systems formed by using fluosulphonic acid in conjunction with the following were investigated: phosphoric, sulphuric, chromic, acetic, and perchloric acids. Among the characteristics of the solutions investigated for bright polishing were current density limits; temperature stability of the solutions; chemical stability of the solutions; and optimum time of polish. (To be continued.)

7-61. Porcelain Enamels for Machine Parts. R. L. Fellows. *Machine Design*, v. 19, Feb. 1947, p. 147-150.

Recently developed enamels and improved methods of processing.

7-62. Ferro Enamel Corp. Opens L. A. Plant. *Western Metals*, v. 5, Feb. 1947, p. 24-27.

Pictures, with explanatory notes.

7-63. Recent Developments in Molybdenum Enamels. B. J. Sweo. *Enamelist*, v. 24, Feb. 1947, p. 4-6.

Chief advantage is that they provide a one-coat white finish which will adhere to steel.

7-64. Quality Enameling in "American Kitchens". *Ceramic Industry*, v. 48, Feb. 1947, p. 44-50.

Details of procedures and equipment used in production of enameled

(Turn to page 26)

Tells of New Lubricant for Drawing Stainless

Reported by A. R. Kunkle
Project Engineer, York Corp.

Each phase of fabrication of the three types of stainless steels (martensitic, austenitic and ferritic) was described by Paul G. Nelson, metallurgist of the automobile body division of the Budd Co., Philadelphia, before the York Chapter on Jan. 8. Mr. Nelson augmented his talk on "Fabrication of Stainless Steels" with several lantern slides showing chemical and physical properties of the three groups.

Mr. Nelson pointed out the precautions to be taken in designing dies for forming operations. Considerable comment was aroused by reference to a new lubricant which is being used by Mr. Nelson's company for deep drawing some stainless steel parts. Filled lubricants, he said, have been satisfactory for mild drawing and forming operations. However, for extremely severe drawing, a recent development—hydrogenated castor oil—has given excellent results. This lubricant, although far more expensive, has reduced die maintenance and stamping breakage sufficiently to more than justify its increased cost.

Mr. Nelson explained the metallurgical reason for carbide precipitation and showed why titanium is added to Type 321 and columbium to Type 347 steels, which are the varieties recommended for parts that are welded or otherwise subjected to high heat.

Welding was discussed in some detail, with recommendations for the use of proper electrodes and subsequent preparation of the welded structure prior to use. In polishing a weld made between two sheets of No. 4 finish stainless steels, Mr. Nelson had been unable to achieve a matching finish, and could give no recommended procedure for polishing.

Passivation was discussed and several chemical combinations recommended for this process.

Talks on Strain Gage Analysis

Reported by M. W. Williams
Hughes Tool Co.

A convincing argument for testing complete units by strain gage analysis was presented before the December meeting of the Texas Chapter by F. G. Tatnall, Eddystone Division of the Baldwin Locomotive Works. Mr. Tatnall's talk, which covered the science of testing materials and use of the data in design, has been reviewed at length in the past, and repetition can be avoided by echoing the sentiments of one of the chapter's better educated scientists on leaving the meeting, who "thought he knew something about testing" but discovered he was "still a freshman".

kitchen units by American Central Division of Aviation Corp., Connersville, Ind.

7-65. Problems in Porcelain Enameling Nonenameling Sheets. Part II. W. A. Deringer. *Ceramic Industry,* v. 48, Feb. 1947, p. 51-52.

Possible cures or antidotes for defects and troubles.

7-66. Metallizing by the Wire Process. *Sheet Metal Worker,* v. 38, Feb. 1947, p. 92-93.

For additional annotations indexed in other sections, see:
11-12; 16-23; 22-91; 23-23; 27-33.

8 ELECTROPLATING

8-13. Comparison of Electroplated Finishes Under Humidity (K.110) Test. *Metallurgia,* v. 35, Dec. 1946, p. 63-64.

Illustrates the effect of 21 cycles in the humidity chamber, operating at 60° C. and at 100% relative humidity. Relative merits of the respective deposits—cadmium, cadmium chromate passivated, zinc chromate passivated, zinc phosphate passivated, nickel, nickel and tin, tin and zinc when subjected to tropical conditions. Comparisons of results indicate that under the conditions of the standard (K.110) test, chromate passivation in the case of cadmium and zinc is definitely advantageous and beneficial.

8-14. Hard Chrome Plating Finds Wide Use at Ford. Herbert Chase. *Iron Age,* v. 159, Jan. 30, 1947, p. 51-53.

A sizable department is maintained for preparing tools and gages, resurfacing parts machined undersize, and for providing surfaces to resist wear in normal service. Applications, handling methods, preplating and stop-off techniques and baths.

8-15. A New Process for Bright Copper Plating. Harold Leever. *Materials & Methods,* v. 25, Jan. 1947, p. 82-84.

New process developed by MacDermid, Inc., Waterbury, Conn. A modified cyanide-type copper solution, with two addition agents, is used. Smooth deposits are claimed from even comparatively dirty solutions.

8-16. Hard Chromium. *Materials & Methods,* v. 25, Jan. 1947, p. 128.

Methods used in application of relatively thick chromium plating, properties of the plate, and applications of the process. (Condensed from paper by D. Chambaud, *Mecanique,* July 1946, p. 175-177.)

8-17. The Control and Maintenance of Electroplating Solutions. Part I. (Continued.) P. Berger. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 135-140.

Acid copper solution, and brass and silver solutions. (To be continued.)

8-18. Synchronized Stamping and Plating. Daniel Dewey. *Steel,* v. 120, Feb. 3, 1947, p. 94-96.

Modern equipment and procedures involved in manufacture of bumper guards, hub caps and other automobile parts. Current plating schedule requires about 90,000 amp. of generator capacity, 35,000 gal. of nickel solution and 3000 gal. of chromium solution per day. Complete laboratory is maintained for regular analysis of the cleaning and plating solutions, as well as for determining plate thickness and salt spray testing.

8-19. Electroforming. (Continued.) E. A. Ollard. *Metal Industry,* v. 70, Jan. 17, 1947, p. 51-53.

Piece part production by electrodeposition. (To be continued.)

8-20. Deposition of Chromium From Chromic Acid Solutions. W. L. Guthrie and F. L. Clifton. *Monthly Review,* v. 34, Feb. 1947, p. 140-153.

Two related methods for determining the characteristics of chromium plating solutions. Only one temperature was investigated in the "worked" baths. Agreement between the results obtained by the two methods is good enough to permit prediction of results from "worked" baths at other temperatures. The same agreement also indicates that barium hydrate can be used successfully in the control of the sulphate ion in chromium plating baths.

8-21. Effect of Impurities and Purification of Electroplating Solutions. D. T. Ewing and William D. Gordon. *Monthly Review,* v. 34, Feb. 1947, p. 180-203.

Bibliography of 666 references covers years 1901-1945, inclusive.

Versatility of the method, together with other advantages of hot metal surfacing.

8-22. Mirror Bright Copper Plating. John Anthony. *Iron Age,* v. 159, Feb. 13, 1947, p. 54-55.

Brightener solution which when added to the conventional copper cyanide plating bath offers promise of lower plating costs by eliminating the need for buffing copper deposits and serves to cut down racking and handling time in the plating shop.

8-23. Periodic Reverse-Current Electroplating. George W. Jernstedt. *Metal Finishing,* v. 45, Feb. 1947, p. 68-72.

A novel, periodic reverse-current plating cycle in which plating current is reversed briefly at short periodic intervals to deplate unsound and inferior metal deposited in the previous plating period. This technique builds up many microscopically thin increments of sound metal to make a deposit more dense and of greater homogeneity than that possible with conventional continuous-current methods.

8-24. Rectifiers for Electroplating. Louis W. Reinken. *Metal Finishing,* v. 45, Feb. 1947, p. 73-77.

Basic rectifier circuits; possible difficulties with single-phase rectifiers; three-phase rectifier circuits; voltage control; tapped autotransformer voltage control.

8-25. Electroplating at Flint's Spark Plug Division. Bryant W. Pocock. *Products Finishing,* v. 11, Feb. 1947, p. 30-32, 34, 36, 38, 40, 42, 44, 46.

Plating department comprises two sections, the die-cast and instrument sections. Die-cast division handles the plating of copper, nickel and chromium on exterior zinc base die-cast parts such as hood ornaments, grille moldings, emblems. Instrument division takes care of similar plating on instrument bezels, retainers, cases, pointers, and trim strips, the basic metal being 1010 or 1020 steel or brass. Equipment and procedures.

For additional annotations indexed in other sections, see:
11-12; 23-23; 27-44.

9 PHYSICAL TESTING

9-7. Effect of Iron and Silicon Impurities on the Tensile Properties and Heat Treatment Characteristics of Sand-Cast Aluminum 10% Magnesium Alloy Test Bars. R. T. Parker, G. M. L. Cox, and A. N. Turner. *Journal of the Institute of Metals,* v. 73, Dec. 1946, p. 175-196.

To explain the differences between melts, groups of D.T.D. test bars were cast in dry sand from melts containing 0.10 to 0.75% iron with 0.10 to 0.50% silicon. While an increase of iron has a slightly beneficial effect, an increase of silicon drastically reduces the ultimate tensile strength and elongation. Proof stress value is slightly increased with increasing total impurity content. Comparison of low and high-purity aluminum, 10% magnesium, alloy test bars under varying heat treatment conditions showed that the high-purity alloy is much more sensitive to differences in solution time and temperature.

9-8. The Falling Sand Abrasion Tester. C. C. Hipkins and R. J. Phair. *ASTM Bulletin,* Dec. 1946, p. 18-22.

The results obtained in a series of tests conducted by the Technical Committee of Protective and Technical Coatings, Chemical Division, War Production Board; some of the variables encountered. Reproducibility is possible with a simple construction and procedure which may be considered as a basis for standardization.

9-9. A New Sandpaper Abrasion Tester. F. M. Gavan, S. W. Eby, Jr. and C. C. Schrader. *ASTM Bulletin,* Dec. 1946, p. 23-29.

An abrasion machine employing a continuously changing abrasive surface has been in use since 1941 in testing various flooring materials, synthetic resins, substitute rubber compounds, metals and painted surfaces. Standard comparison specimens of zinc are tested with each run. Measurements taken on these standards over a period of years have shown the method to be reasonably consistent.

9-10. A Method for Predicting Failure of Metals. P. E. Cavanagh. *ASTM Bulletin,* Dec. 1946, p. 30-33; discussion, p. 33-35.

Possibilities of using changes in high-frequency magnetic and eddy-current losses to predict failure in metals. Method of recording changes in total magnetic and eddy-current losses (or "core losses"); examples of stress-core loss curves obtained.

9-11. Pneumatic Fatigue Testing. F. B. Quinlan. *Automotive and Aviation Industries,* v. 96, Jan. 15, 1947, p. 30-31, 94, 96.

Design features of a pneumatic testing machine which will fatigue test, in reversed bending, the turbine buckets used in turbosuperchargers and jet engines.

9-12. Eenige Beschouwingen Over Trekkrommen. (Some Considerations Concerning Tensile Testing.) J. H. Palm. *Metalen,* v. 1, Dec. 1946, p. 55-61; Jan. 1947, p. 85-88.

Diagrams in which true stress is plotted against degree of deformation are more suitable for comparison and evaluation of metals than the load-elongation diagrams obtained from tensile testing machines. Diagrams in which conventional strain, local strain, and reduction of neck cross-section are used as a measure of degree of deformation. Mathematical relationships between true stress and true strain. Phenomena of single and plural necking, stress distribution in the neck and corresponding mode of fracture. 14 ref.

9-13. New Tester Reveals Tungsten Wire Defects. *Iron Age,* v. 159, Jan. 30, 1947, p. 56.

Instrument permits tungsten wire for lamp and radio tube filament production to be subjected to rigid physical test which will accurately reveal flaws or seams in the wire. An outstanding feature of the apparatus is the ability to test a 3-ft. length of wire at one time.

9-14. Determination of Limit of Proportionality of Wires. F. C. Thompson and W. R. Tyldesley. *Nature,* v. 159, Jan. 4, 1947, p. 30.

Novel technique in which the wire itself is used as a "strain gage", the increase of electrical resistance as the load is increased being measured. Typical results are plotted.

9-15. Some Unusual Tests of Cast Iron. James S. Vanick. *Foundry,* v. 75, Feb. 1947, p. 78-83.

Second of two articles describes fatigue, impact, corrosion and heat resistance test methods which differ

(Turn to page 28)

Raw Material Control Improves Economy Of Blast Furnace Operations—Johnson

Reported by Hans J. Heine
Metallurgist, Rockwell Mfg. Co.

The role of raw material control in improving economy of operations was the nucleus of a talk on "Blast Furnace Operation and Materials" delivered by H. W. Johnson, staff assistant to the president, Inland Steel Co., Chicago, before the annual Sustaining Members' Night of the Pittsburgh Chapter.

The blast furnace process has not changed in principle for the past 600 years, Mr. Johnson pointed out. Its importance continues, as evidenced by the fact that 15% of all coal mined is used in blast furnaces.

Unfortunately, blast furnace operations are often inefficient, because the quality and size of both the coke and the iron ore vary. Nonuniform voids in the charge result in nonuniform flow of gas because of segregation of coarse and fine material.

Efficiency of blast furnace operation is indicated by the distribution of CO_2 content across the cross-sectional area, Mr. Johnson said. A lower CO_2 content in the top gas is associated with a lower efficiency. By changes in operation, the flow of gas can be influenced. The zones of fines will be low in temperature, in gas velocity, and in CO_2.

For a clear understanding of the reduction process in the blast furnace it is important to picture the uprushing of gases coming into contact with the descending burden. A gas velocity of 270 miles per hour can be attained. The stock column is 90 ft. high and may weigh over 1000 tons. Some of the solids are actually in suspension in the uprushing blast.

The speaker then focused his attention on the problem of what is being done to increase production. Hearth diameter can be increased, but that is expensive. Number of voids can be increased by sizing the ore. A comparison between prepared and unprepared ore, reported by Herman Dolscha of Carnegie-Illinois Steel Corp., showed that a properly sized ore *(a)* increased production 13.6%; *(b)* reduced amount of coke used 8%; *(c)* produced a leaner top gas, i.e., a gas of lower B.t.u.

Coke can be improved by washing the coal. Reduction in slag and sulphur content will improve the physical characteristics of the coke. Effects of washing are less sulphur, less ash, and higher percentage of carbon, an increase in moisture, and an increase in the capacity of the blast furnace. C. D. King, chairman of operating committee, United States Steel Corp., who led the lively discussion period, reported that washing the coal increased iron production by 8.1%, and decreased the amount of coke needed by 7.8%. The slag volume was decreased by 20%.

Another way of increasing blast furnace output is to replace air by oxygen. Adding oxygen does not, however, change the voids.

At Left Is H. W. Johnson, Special Staff Assistant to the President, Inland Steel Co., Who Addressed the Pittsburgh Chapter on Blast Furnace Operation and Materials, and at Right Is C. D. King, Chairman of Operating Committee, United States Steel Corp., Who Contributed Some Interesting Facts on Coal Washing to the Discussion

Difficulties in Welding Aluminum Exposed

Reported by James W. Haupt
Engineer, Cardwell Mfg. Co., Inc.

Although its uses are limited by its low strength, pure aluminum is more easily welded than its alloys, according to G. O. Hoglund of the Aluminum Co. of America. The reason for this, he explained, is that, in general, as the strength is increased by the addition of alloys, the melting range widens, which increases the difficulty of welding.

Mr. Hoglund addressed the Wichita Chapter on Jan. 23 on "Welding and Brazing the Aluminum Alloys".

Since the thermal conductivity and coefficient of expansion of aluminum are higher than for steel, more heat is required during welding and also more attention must be given to holding the parts in position. Mr. Hoglund emphasized, however, that in spite of these difficulties aluminum can be successfully welded with a proper understanding of these conditions. Oxide coating of aluminum also causes difficulty in welding and requires the use of a flux.

Mr. Hoglund gave a description of automatic gas welding, flash welding, tungsten-arc welding and brazing. The program closed with the showing of two moving picture films—one dealing with torch welding of aluminum and the other showing brazing.

from standardized procedures. Methods have been compiled by an A.S.T.M. Committee.

9-16. Tensile Strength of Aluminum. Giordano Bruni. *Metal Industry,* v. 70, Jan. 24, 1947, p. 71-72.

Experimental determination of this value at the melting point. The value obtained was confirmed by extrapolating the tensile strength curve to the melting point.

9-17. Ueber Transversale Stabschwingungen und Dauerbruche. (Concerning Transverse Oscillation and Fatigue Rupture.) P. Matthieu. *Schweizer Archiv,* v. 12, Nov. 1946, p. 329-338; Dec. 1946, p. 361-372.

Some of the problems of the determination of stresses in a rod under the effect of transverse oscillating forces were investigated. Solution of such problems consists of: first, calculation of the form of oscillation and, second, determination of the relationships between form of oscillation and fatigue strength limits. Points of maximum stress are located in different parts of the test specimens than was expected. On the basis of the location of these points, the nature of the fatigue stress inducing fracture can be determined.

9-18. Microhardness Testing of Small Tools. G. E. Shubrooks. *Modern Machine Shop,* v. 19, Feb. 1947, p. 124-130, 132, 136.

How the Tukon tester is used with the Knoop indenter to test the hardness of small tools and other extremely small objects.

9-19. Cooling Rate of Test Bars. *Gray Iron Progress,* v. 4, Feb. 1947, p. 4-6.

Results of recent work on standard 1.2-in. bars.

9-20. The Detection of Fatigue Cracks. C. W. Orr. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 9,* Dec. 1946, 14 p.

Various methods and equipment used for crack detection in both ferrous and nonferrous materials. Magnetic particle, fluid penetration, radiographic, etching, lacquer coating, eddy current, and sonic methods and the advantages and limitations of each. Crack propagation and the question of when to inspect and when to reject for fatigue cracks.

9-21. Methods of Investigating the Fatigue Properties of Materials. W. W. Johnstone. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 11,* Dec. 1946, 27 p.

Basic test procedures and some of the common influencing factors. Mechanical methods as used at the C.S.I.R. Division of Aeronautics. Notes concerning other methods.

9-22. Fatigue Tests on Four Welded H-Beams. A. L. Percival and R. Weck. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 14,* Dec. 1946, 20 p.

A method of testing large beam specimens by resonant vibration excited by a mechanical oscillator. Nodal support confines the vibration to the specimen and avoids the use of heavy foundations and the loss of power to the supports. Oscillator consists of two eccentric masses geared together to rotate in opposite directions and is driven by a d.c. motor, speed of which is automatically controlled to maintain a constant amplitude of vibration of the specimen. Mathematical relationships between the stress, amplitude and position of nodes are derived for a uniform beam with a central mass. Specimens used were welded H-beams 6 in. x 5 in. in section and 12 ft. 6 in. long.

9-23. Fatigue Problems in the Gas Turbine Aero Engine. A. R. Edwards. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 22,* Dec. 1946, 12 p.

Major sources of vibration in gas turbines; it is noted that vibrations arising from aerodynamic causes predominate. Mechanically induced vibrations are negligible due to the absence of reciprocating parts. Various design features which aim particularly at the alleviation of vibration and fatigue troubles. Problems involved in the fatigue testing of turbine blades and the limitations of existing laboratory testing equipment. Influence of creep on endurance stresses, as determined by present laboratory methods, at frequencies which are only a small fraction of the vibration encountered in the operating turbine.

9-24. Dislocation Theory as Applied by N.A.C.A. to the Creep of Metals. A. S. Norwick and E. S. Machlin. *Journal of Applied Physics,* v. 18, Jan. 1947, p. 79-87.

An equation for steady-state creep rate in terms of a specific dislocation mechanism which involves considering the generation of dislocations to be a rate process. Theories of rate processes and of dislocation required for the development of the creep equation. 17 ref.

9-25. Creep Deflections in Columns. Joseph Marin. *Journal of Applied Physics,* v. 18, Jan. 1947, p. 103-109.

Rational theory for predicting creep deflections in columns. A special case is applied to the interpretation of some preliminary tests of an aluminum alloy.

9-26. Tuned Air Columns Induce Resonance for Fatigue Testing. *Product Engineering,* v. 18, Feb. 1947, p. 98.

Tuned air columns vibrate the test piece at its own resonant frequency to simulate dynamic loading conditions of reverse bending. Design details of pneumatic fatigue machine.

9-27. The Fatigue Characteristics of Bolted Lap Joints of 24S-T Alclad Sheet Materials. L. R. Jackson, W. M. Wilson, H. F. Moore and H. J. Grover. *National Advisory Committee for Aeronautics Technical Note No. 1030,* Oct. 1946, 67 p.

Details of investigation conducted jointly by Battelle Memorial Institute and University of Illinois, and the results obtained. Main objectives were determination of effect on fatigue strength of such factors as bolt fit, number and arrangement of bolts, and sheet gage (for a given bolt diameter). Sheet thicknesses ranged from 0.102 to 0.375 in. About 950 specimens were tested.

9-28. Fracture of Some Aluminum Alloys Under Combined Stress. E. G. Thompson, D. M. Cunningham and J. E. Dorn. *Transactions of the American Society of Mechanical Engineers,* v. 69, Feb. 1947, p. 81-87.

Thin-walled tubular specimens of aluminum alloys 24S-T, 24S-T80, and 24S-T81 were subjected to axial loads and internal pressures. Ratios of load to pressure were adjusted to give stress ratios covering the tension-tension and tension-compression fields of biaxial stress. Predictions based upon the "critical normal stress law" were in serious disagreement with the experimental facts, while predictions based upon the "critical shear stress law" were in approximate agreement. (From Part 19, O.P.R.D. Report No. W-225, July 27, 1945.)

For additional annotations indexed in other sections, see:
3-34-35-36-38-39-41-50; **24**-35-36-48-50-56; **27**-48.

10 ANALYSIS

10-18. A Rapid Method for the Analysis of Light Alloys, Based on Electrical Resistivity. L. Rotherham and J. I. Morley. *Journal of the Institute of Metals,* v. 73, Dec. 1946, p. 213-222.

Variation of electrical resistivity with composition in light alloys corresponding to the specifications D.T.D. 300 and 59A, in one case correlating resistivity with magnesium content and in the other with aluminum content. The results obtained depended on porosity, microstructure, and details of the casting procedure, but with careful control, a straight-line relationship between alloy content and resistivity can be obtained. Details of investigation and recommended procedure.

10-19. The Determination of FeO in Steel From the Carbon Drop. R. J. Sarjant. *Iron and Steel Institute Advance Copy,* Dec. 1946, 6 p.

Several forms of nomographs applicable to the determination of FeO in molten steel from the carbon drop. A variation of equilibrium temperature is included in a revised nomograph, calculated from the free-energy equation of Vacher and Hamilton. Some correlation was found with results of oxygen determinations reported by Bramley, Maddocks, and Tateson. A simple nomograph was also constructed for use at 1600° C. Reviews previous work on the determination of FeO in molten steel, and on the values of the velocity and equilibrium constants required for an accurate definition of the fundamental equation governing the reaction between FeO and carbon.

10-20. The Rapid Determination of Reactive Oxygen in Openhearth Steel. I. M. MacKenzie. *Iron and Steel Institute Advance Copy,* Dec. 1946, 5 p.

An experimental method of determining the reactive oxygen in liquid. Results correlate with the carbon content and the rate of carbon drop. A formula expressing the relationship is derived enabling the reactive oxygen, during the later stages of the boil, to be calculated or determined graphically from the carbon-drop curve.

10-21. The Colorimetric Estimation of Antimony in Aluminum Alloys Using Potassium Iodide and Thiourea. J. H. Bartram and P. J. C. Kent. *Metallurgia,* v. 35, Dec. 1946, p. 91-92.

Colorimetric method for the estimation of antimony in aluminum alloys shows very good agreement with the volumetric and polarographic methods; reproducibility of results is also of a high order. The method is applicable to brass and bronze using a slightly different opening technique.

10-22. A Compound Method for the Absorptiometric Analysis of High and Super High Speed Steels. F. E. Eborall. *Metallurgia,* v. 35, Dec. 1946, p. 104-106.

Cobalt, chromium, vanadium, nickel, molybdenum and manganese are determined on one sample weight. Tungsten is separated, and the adsorbed molybdenum and vanadium separated along with the tungsten are determined. Other elements are determined utilizing modifications of previously published methods.

10-23. The History and Present Status of Emission Spectroscopy as Applied to Industry. Part III. John Convey. *Metallurgia,* v. 35, Dec. 1946, p. 107-110.

The photometry and calibration of spectrograms, and some of the efforts made to effect direct intensity measurements of spectral lines. In recent years spectral excitation methods have improved and photomultiplier tubes with greatly increased sensitivity have become commercially available.

10-24. 1:2-Cyclohexanedione-Dioxime ("Nioxime") as a Reagent for Nickel. W. C. Johnson and M. Simmons. *Analyst,* v. 71, Dec. 1946, p. 554-556.

Above compound has been investigated as a qualitative, gravimetric and colorimetric reagent for nickel and has been found to offer advantages except in gravimetric work. Colorimetric methods described.

10-25. The Determination of Mercury and Copper in Antifouling Compositions: Potassium Cobalticyanide as Complex-

(Turn to page 30)

Three Speakers Discuss Ferrous and Nonferrous Metals and Plastics

Reported by Frank Kristufek

U. S. Steel Corp. Research Laboratory

"Materials for Specific Purposes" was the subject of a panel discussion sponsored by the New Jersey Chapter ⊛ in which three speakers discussed ferrous metals, nonferrous metals, and plastics.

Speaking on ferrous metals, Melvin H. Young, chief of the materials laboratory of Wright Aeronautical Corp. at Wood Ridge, N. J., listed three important factors in selecting a material for a given product. They are *(a)* the function of the part to be manufactured, *(b)* the fabrication or manufacturing limitations, and *(c)* cost and availability of material. General commercial practice is to use the material that gives satisfactory performance at lowest cost. Chief disadvantages of most ferrous metals are poor corrosion resistance, great weight per unit volume, and poor bearing properties.

Nonferrous metals were discussed by W. C. Schulte, quality manager of the Curtiss-Wright Corp., Propeller Division, at Caldwell, N. J. The decision to use nonferrous materials instead of steel, he said, may be because of such properties as corrosion resistance, light weight, electrical conductivity, ease of machining, good bearing properties, and ease of die casting.

Disadvantages generally common to aluminum and magnesium alloys are limitations in design because of poor notch impact properties, larger volume of metal required because of comparatively low compressive yield strength, and higher cost than steel.

In his part of the program, A. J. Warner, an engineer of the Federal Telecommunication Laboratories at Newark, N. J., stated that the plastics industry has grown rapidly, particularly in the last five years. The tremendous recent expansion of the magnesium industry is only about one-half as rapid as the growth in production of polystyrene in the plastics industry.

Polystyrene, the oldest synthetic organic plastic known, is used extensively commercially and showed an increase from 2.6 million lb. in January 1946 to 5.7 million lb. in November 1946, whereas the cost per pound has decreased from about $8.00 prior to 1935 to $.25 to $.30 per lb. at present.

Two distinct classes of plastics are the thermosetting, such as bakelite, and the thermoplastic, such as nylon. It is Mr. Warner's belief that future developments in the plastics fields will tend more and more toward the use of thermoplastic materials and away from the conventional thermosetting materials. Intensive research is being carried on to discover a plastic material suitable for use at high temperatures, and it is reported that a new one that will withstand 500° F. has been developed for certain cable uses in jet propelled planes.

Slidefil: s Teach Lathe Work

By Lyne S. Metcalfe

A series of 11 discussion-type basic training slidefilms, "Safe Practices in Metalworking—the Engine Lathe", has been made available to trade schools, vocational training organizations and the various divisions of the metalworking industries. These films were produced and are being distributed by the Jam Handy Organization.

This series combines instruction of safe practices along with machine or workshop activities. The apprentice metalworker is shown how to do it safely at the same time he is being taught how to do it properly.

Richard S. Read, Pioneer In Electric Melting, Dies

Richard S. Read, 72, a pioneer in the development of electric furnace steel manufacture, died Feb. 5 at Syracuse, N. Y. He was superintendent of melting at the Halcomb Works of the Crucible Steel Co. of America.

Mr. Read's experience with electric steel melting began in 1905 when he, with officials of the then recently organized Halcomb Steel Co., arranged for the purchase of a single-phase three-ton electric furnace from Paul Heroult, the French designer. From this time on, he took an active part in the development of electric melting procedures for complex alloy steels.

Mr. Read was a charter member of the Syracuse Chapter ⊛ and a past president of the Electric Metal Makers Guild. The October 1946 issue of *Metal Progress* carried an extended biographical appreciation of him.

Forming Agent in Dithizone Technique. H. Barnes. *Analyst*, v. 71, Dec. 1946, p. 578-583.

Method using dithizone and sodium diethyldithiocarbamate. A simple wet ashing procedure described. Use of potassium cobalticyanide and a chloroform solution of dithizone for the elimination of interference due to copper (even when present in considerable excess) in the determination of mercury.

10-26. The "Bone and Wheeler" Gas-Analysis Apparatus. L. J. Edgcombe. *Fuel in Science and Practice*, v. 25, Nov-Dec. 1946, p. 163-166, 171-177.

The constant volume principle is used in the instrument described. In this type of apparatus, an unknown volume of gas is expanded to a fixed volume and the pressure measured. On removal of each constituent, the remaining gas is expanded to the original volume and the pressure measured. Advantages over the constant pressure type. The original Bone and Wheeler apparatus has been standardized as to dimensions to facilitate replacement of units. Drawings of the construction of the apparatus. 12 ref.

10-27. Influence of Iron on Induction of MoO_3 to MoO_2 During the Determination of Phosphorus. A. Malkov. *Journal of Applied Chemistry (U.S.S.R.)*, v. 19, no. 5 and 6, 1946, p. 577-579. (In Russian.)

Colorimetric and oxidimetric methods may lead to erroneous results in the presence of iron.

10-28. Determination of Titanium Nitride in Ferro-Alloys. Louis Silverman. *Iron Age*, v. 159, Feb. 6, 1947, p. 68, 153.

Samples were prepared according to the procedure outlined and the residues analyzed by X-ray diffraction methods.

10-29. Use of Incompletely Consumed Samples to Illustrate Effect of Fractional Distillation in Carbon-Arc Spectrochemical Analyses. Lester W. Strock and George E. Heggen. *Journal of the Optical Society of America*, v. 37, Jan. 1947, p. 29-36.

It was hoped that a cut-off technique would permit use of beryllium as an internal standard. However, the data presented show that, while sufficient beryllium does participate in the arcing process to provide an intensity standard line, the cut-off point lies in a range where intensity ratios are changing so rapidly as to be poorly reproducible. However, the results do illustrate many basic features and sources of difficulty in d.c. carbon-arc spectrochemical analyses.

10-30. An Aliquot Procedure for Steel Analysis Using Colorimetric Methods. Henry Seaman and Wm. S. Levine. *Chemist Analyst*, v. 35, Dec. 1946, p. 78-80.

Results in considerable time saving in routine analysis of large numbers of steel samples.

11 INSTRUMENTS
Laboratory Apparatus

11-12. Investigation of Methods of Determining the Weight or Average Thickness of Tin on Tin-Coated Copper and Brass. K. R. Hanna. *ASTM Bulletin*, Dec. 1946, p. 35-37.

Method recommended involves the selective stripping of tin in a boiling solution of sodium hydroxide containing suspended bismuth hydroxide. Two other methods involving the use of sodium hydroxide-potassium iodate solution and a trichloroacetic acid solution, respectively, are suggested as alternatives.

11-13. Low-Order Multiple-Beam Interferometry. S. Tolansky. *Proceedings of the Physical Society*, v. 58, Nov. 1, 1946, p. 654-662.

Factors affecting the intensity and sharpness of multiple beam Fizeau fringes and fringes of equal chromatic order used for the study of surface topography. Effects of the absorption in the silver film, phase condition, linear displacement of the beams, finite size of source, departure from parallelism, and source line width. 11 ref.

11-14. Geometrical Problems of the Reflection Goniometer. M. Fehr. *Industrial Diamond Review*, v. 7, Jan. 1947, p. 6-8.

Clarifies a number of problems involved in proper use of above instrument for measurements required in production of diamond and other tool edges.

11-15. Electronics in Industrial Process Measurements. Douglas M. Considine and Donald P. Eckman. *Radio News*, v. 37, Feb. 1947, Engineering Dept. p. 16-17, 26-28.

Electronic potentiometers; Geiger-counter X-ray spectrometer; recording polarograph; ultraviolet spectrophotometers; infrared spectrophotometers; instruments for measuring high vacuums; refinements in pH measurement.

11-16. Metallurgical Application of the X-Ray Diffraction Spectrometer. Part I. John L. Abbott. *Iron Age*, v. 159, Feb. 13, 1947, p. 50-53.

Various aspects relating to the operation of the equipment and diffraction curves which indicate the effects of apparatus variables on diffraction patterns.

11-17. X-Ray Flicker Photometer. C. D. Moriarty. *General Electric Review*, v. 50, Feb. 1947, p. 39-42.

New method of nondestructive testing, utilizing combination of X-rays and phototubes for measuring X-ray absorption of materials.

11-18. X-Ray Photometer. T. C. Michel and T. A. Rich. *General Electric Review*, v. 50, Feb. 1947, p. 45-48.

An instrument designed for general commercial application.

11-19. Nouvelle Methode pour Determiner au Moyen des Rayons X l'Orientation Cristallographique d'Une Section Plane de Monocristal Epais. (A New Method for the X-Ray Determination of the Crystallographic Orientation of a Plain Section of a Thick Monocrystal.) Rene Graf. *Comptes Rendus*, v. 223, Dec. 23, 1946, p. 1152-1154.

A new method permitting the use of much smaller angles of diffraction permits reduction of time of exposure, and increase in the sharpness of the pattern.

11-20. Metallurgical Applications of the X-Ray Diffraction Spectrometer. Part II. John L. Abbott. *Iron Age*, v. 159, Feb. 20, 1947, p. 57-61.

Effects of heat treatment on the X-ray diffraction patterns of S.A.E. 3312 steel and 24S aluminum, and the effects of cold working on the X-ray diffraction pattern of S.A.E. X4340 steel. Correlates the metallurgical structure of each specimen with the corresponding diffraction curve.

For additional annotations indexed in other sections, see: 10-26; 23-26; 27-47.

12 INSPECTION AND STANDARDIZATION

12-22. Important New Actions on Standards. *ASTM Bulletin*, Dec. 1946, p. 8-10.

Nature of the new and revised standards for nonferrous metals, clay tile, electrical insulating materials, welding electrodes, aluminum and magnesium, and petroleum tests.

12-23. Material Purchase Specifications. S. B. Ashkinazy. *ASTM Bulletin*, Dec. 1946, p. 48-51.

Composition-type specification; properties-type specification; and performance-type specification. 27 ref.

12-24. Report of Activities of A.I.S.E. Standardization Committee, 1946. *Iron and Steel Engineer*, v. 24, Jan. 1947, p. 98-109.

Report includes introduction and separate reports on design of ladle hooks and hot metal ladles; chains and slings; shunting for motor brushes; surface finish designation; dirt in steel mill atmospheres; turbine inspection; inspection practices for maintenance of mill buildings; fuel, furnace, ceramics, and control engineers' handbook; handbook of lubrication standards for the steel industry; plain bearings; safety switches; flexible and solid couplings; wiring diagram and control schemes.

12-25. Multiple Air Gaging Operations. W. Fay Aller. *American Machinist*, v. 91, Jan. 30, 1947, p. 101-103.

Applications of several gaging heads developed for internal and external measurements.

12-26. Sheet Steel. Nomenclature in the Measurement of Thickness—Conversion Formulas. J. H. Mort. *Iron and Steel*, v. 20, Jan. 1947, p. 9-11.

Bases on which the various gage tables are founded and conversion formulas showing the connections between them.

12-27. Machinability. Ernest J. Baty. *Iron and Steel*, v. 20, Jan. 1947, p. 23-25.

An induction test for the rapid sorting of machinable from unmachinable bars.

12-28. Report of Committee 15—Iron and Steel Structures. *American Railway Engineering Association Bulletin*, v. 48, Jan. 1947, p. 389-395.

Includes revisions of specifications for steel railway bridges and other parts; specifications for fusion welding and gas cutting for steel structures, collaborating with A.S.T.M. Committee A-1 on steel, and the American Welding Society Conference on bridges.

12-29. Checking Concentricity of Round Parts. *Steel*, v. 120, Feb. 3, 1947, p. 127.

By automatically determining the proper center-line heights for any combination of diameters involved in a workpiece, the V-liner shown eliminates use of complicated measuring equipment and mathematical computations in checking relative concentricities on round parts or sections.

12-30. Inspection of Railroad Car Parts. C. B. Bryant. *Railway Mechanical Engineer*, v. 121, Feb. 1947, p. 73-74; discussion, p. 74-77.

Partial report of Conference on Magnaflux Inspection held in Chicago early in 1946.

12-31. Testing With Magnaflux on the D. & R.G.W. Ray McBrian. *Railway Engineering and Maintenance*, v. 43, Feb. 1947, p. 137-139.

Practices and experience of the Denver & Rio Grande Western in testing of various components of the track structure, track tools and other items used by maintenance of way and other departments.

12-32. Quality Control Aids Supervisors. Part I. David T. Armstrong. *American Machinist*, v. 91, Feb. 13, 1947, p. 101-105.

Basic principles of quality control and shows the shop man how to interpret control chart.

12-33. Recommended Practices for Dimensioning and Tolerancing. Merhyle F. Spotts. *Product Engineering*, v. 18, Feb. 1947, p. 88-91.

(Turn to page 32)

Tells How Fracture Studies Explain Failures

R. E. Peterson of Westinghouse Electric Corp. (Center) Talked on Fractures and Their Characteristics Before the West Michigan Chapter. At left is Roy Nelson, chapter chairman, and at right Richard Hammerstein of Park Chemical Co., who acted as technical chairman

Reported by Allen M. Allor
Michigan Light Alloys

Two sources of information for the study of fractures in metals are stress analysis and laboratory duplication of field conditions, R. E. Peterson pointed out in opening a talk on "Fractures and Their Characteristics". Mr. Peterson, who is manager of the mechanics department, Westinghouse Electrical Corp., addressed the West Michigan Chapter ⊕ on Jan. 20.

Mr. Peterson grouped failures in three main classifications: *(a)* fatigue —failures due to repeated stresses, subdivided under bending, torsion, and special cases; *(b)* creep rupture—failures at high temperature and under heavy load; *(c)* plate failures.

Identification of the cause of failure by visual inspection of the fracture was explained by Mr. Peterson. Discussing corrective measures, he cited the pitting of gear teeth as an example. This failure was caused by "hydraulic wedges" formed by lubricating oil getting into fatigue cracks on the surface of the teeth. Remedies for this condition were:

1. Use of heavier oil which cannot work into the imperfections in the metal as readily.
2. Increasing the hardness of the gears to resist hydraulic impact.
3. Providing the best possible surface finish.

Laboratory facilities should be used to their fullest extent in determining causes of failure, and Mr. Peterson cautioned against judging by false conclusions often so readily drawn. For instance, a shaft that apparently failed by fatigue was found to have broken before it was ever put into service because of an impact during transportation to the job; the real cause of the failure was faulty heat treatment.

A new development described by Mr Peterson was the inspection of large forgings by radar methods.

New Research Company Formed

Horizons, Inc., a new research company with headquarters in Princeton, N. J., will engage in research and development in the fields of chemistry, metallurgy and ceramics. The research staff will be directed by Eugene Wainer, formerly associate director of research of the Titanium Alloy Manufacturing Co.

Solution of Some Problems In Corrosion Discussed

Reported by Knox A. Powell
Research Engineer
Minneapolis-Moline Power Implement Co.

Corrosion rate depends not only upon the combination of materials in contact, but also on the temperature, the available oxygen, the surface velocity, the continuity of the corrosion resisting film, and the heat treated condition of the corroded material, Herbert O. Teeple of the corrosion engineering department of the International Nickel Co. explained to the Northwest Chapter's January meeting. The talk was entitled "Some Problems in Corrosion".

Mr. Teeple outlined experimental work on liquid and gas corrosion problems in the dye, oil refining, and copper smelting industries, illustrating the principal causes, and showing how the most economical method of inhibition is determined. High-silicon iron, high-chromium alloys and copper alloys (as well as nickel alloys) were included in the tests described.

A most interesting corrosion problem involved many tons of plate in a long duct. By merely applying heat insulation to the existing mild steel to keep the metal temperature above the dew point of the gas, corrosion was made negligible. Other corrosion problems could probably be solved by similar treatment, as indicated by the general discussion.

Dimensioning of cylindrical fits; dimensioning of tapers; positional tolerances; inspection by fixed position gages.

12-34. The Use of Instruments for Controlling Quality. Joseph Manuele. *Machinery*, v. 53, Feb. 1947, p. 156-159.

A quality control program based on a gaging method that shows the divergence of parts from specifications resulting in less scrap loss, and consequently in lower production costs.

For additional annotations indexed in other sections, see:

3-32-36-40-42-43-44-46; **9**-20; **11**-17; **14**-39; **19**-37; **24**-49; **25**-19-21; **27**-40-42-45.

13 PYROMETRY Temperature Control

14 FOUNDRY PRACTICE

14-35. Unsoundness in Cast Light Alloys. Part I. *American Foundryman*, v. 11, Jan. 1947, p. 24-40.

Deals mainly with unsoundness which arises from the gas evolved from the melt when it solidifies, or from the combined effects of both. Discussion confined to castings produced by either the sand-cast method or permanent-mold method, but not by the die-cast method.

14-36. Gypsum Cement—Practical Patternmaking Applications. E. H. Schleede. *American Foundryman*, v. 11, Jan. 1947, p. 46-50.

Applications to patternmaking include checking of core box by "booking" method; correcting a pattern for metal shrinkage. Data about gypsum cement to aid patternmaker in further applications.

14-37. Molding Sand. Brass and Bronze. L. B. Osborn. *American Foundryman*, v. 11, Jan. 1947, p. 53-57; discussion, p. 57-58.

Nonferrous foundry sand problems. Properties of natural and synthetic sands and the requirements for different types of castings.

14-38. The Liquefaction and Solidification of Die-Casting Alloys. L. J. Gouttier. *Machinery (London)*, v. 69, Dec. 26, 1946, p. 830-833.

Way in which the technique used in die casting of alloys should be controlled by utilization of the equilibrium melting point diagrams for the various alloy systems.

14-39. Control in a Mechanized Jobbing Steel Foundry. D. Brown. *Foundry Trade Journal*, v. 80, Dec. 26, 1946, p. 421-426, 430.

Some of the problems encountered in a jobbing foundry which handles lots of 50 to 1000 pieces on each order, and methods used to solve these problems.

14-40. Influence of Design and Patternmaking on Foundry Technique. (Continued.) T. H. Sneddon. *Foundry Trade Journal*, v. 80, Dec. 26, 1946, p. 427-429.

"V" cutter castings; "roller" castings; manganese steel castings; contraction allowances.

14-41. The Year's Progress in the Production and Application of Alloy Cast Irons. A. E. McRae Smith. *Metallurgia*, v. 35, Dec. 1946, p. 93-96.

The year has been one of consolidation of the results of past experience, particularly experience gained during the war years when many foundries obtained first class melting plant and sound technical advice. Wider use of ladle additions has resulted in some progress in the production of alloy cast irons of varying composition and physical properties from a single base mixture.

14-42. An Engineer Looks at Sand Problems. Earl E. Woodliff. *Foundry*, v. 75, Feb. 1947, p. 66-67, 182, 184, 186, 188, 190.

Sand control, properties of various sands, core oils, binders, test procedures.

14-43. Producing Large Steel Castings. Pat Dwyer. *Foundry*, v. 75, Feb. 1947, p. 74-77, 224, 226, 228.

One of a series describing various casting facilities of Bethlehem Steel Co. Equipment and technique.

14-44. Modern Improvements in the Chilled Car Wheel. L. H. Rudesill. *Foundry*, v. 75, Feb. 1947, p. 84-87, 170, 172, 175.

Recent improvements in the manufacturing process, especially those developed by Griffin Wheel Co. in cooperation with the Association of Manufacturers of Chilled Car Wheels, include scientific cupola and melting control; tellurium-graphite inoculating practice; chill control; metal temperature control; improved annealing practice; and improved design.

14-45. Formulas for Determining the Weights of Castings. (Continued.) *Foundry*, v. 75, Feb. 1947, p. 121-122.

Formulas and tables presented for weights of segment of an ellipsoid when base is parallel to the revolving axis; ring of elliptical cross section; solid generated by revolving a plane area about an axis; ring of circular cross section; sector of a paraboloid. (To be concluded.)

14-46. New Brass Foundry Makes Plumbing Fixtures. Walter Rudolph. *Foundry*, v. 75, Feb. 1947, p. 128.

Equipment and technique at Hays Mfg. Co.'s new foundry at Albion, Pa.

14-47. Malleable Cast Iron. H. G. Hall. *Foundry Trade Journal*, v. 81, Jan. 16, 1947, p. 53-57.

Present state of knowledge concerning malleable cast iron and its structure and necessity for further research and development. (To be continued.)

14-48. A Permanent Mold Material. O. Smalley. *Steel*, v. 120, Feb. 3, 1947, p. 108, 158.

Advantage of Meehanite in providing consistent uniformity of metal structure.

14-49. Nonporous Bronze. E. R. Thews. *Metal Industry*, v. 70, Jan. 24, 1947, p. 65-67.

Gas absorption, reducing gases, "tin sweat", fluxes, melting and alloying, and 25 rules for melting and casting. (To be concluded.)

14-50. Formulas for Determination of the Coefficient of Friction of Molten Metal Flow. E. Z. Rabinowitch. *Reports of the Academy of Sciences of U.S.S.R.*, v. 54, Nov. 11, 1946, p. 395-397. (In Russian.)

Ruff's formulas are analyzed. Author believes that Ruff's method of generalization of empirical data results in an erroneous conception of this phenomenon.

14-51. Refractory Coatings for Permanent Molds. Harold E. Bourassa. *Iron Age*, v. 159, Feb. 6, 1947, p. 58-59.

Results of an investigation to determine the effectiveness of various types of coatings for permanent molds. Method of applying coatings.

14-52. Side-Blow Converter at Harrison. *Gray Iron Progress*, v. 4, Feb. 1947, p. 3-4.

Operation of converter at Harrison, N. J., works of Worthington Pump and Machinery Corp.

14-53. Operation Data at Harrison. *Gray Iron Progress*, v. 4, Feb. 1947, p. 7-9.

Foundry practice at Harrison, N. J., works of Worthington Pump and Machinery Corp., including several of the sand mixtures used.

14-54. Nonporous Bronze. (Concluded.) E. R. Thews. *Metal Industry*, v. 70, Jan. 31, 1947, p. 89-90.

Special fluxes; air pressure; phosphorus-copper; melting and casting rules; crucible melting; sand.

14-55. Some Practical Aspects of Bronze Founding. F. C. Evans. *Proceedings of the Institute of British Foundrymen*, v. 38, 1944-1945, p. B114-B121.

Classification of bronzes; melting; molding sands; core sands; molding technique for tin.

14-56. A Survey of the Principles of Light Alloy Foundry Technology. M. R. Hinchcliffe. *Proceedings of the Institute of British Foundrymen*, v. 38, 1944-1945, p. B122-B133.

Physical and chemical characteristics; melting and molding of aluminum and magnesium alloys; casting techniques.

14-57. How Baltimore Foundry Reclaims Shakeout Sand. *Link-Belt News*, v. 14, Feb. 1947, p. 1, 5.

Mechanical sand preparation and conveying system used by small foundry.

14-58. Vacuum Casting Reduces Scrap Loss. *Production Engineering & Management*, v. 19, Feb. 1947, p. 77.

Counter-gravity vacuum casting (a process developed by the Armour Research Foundation) which has reduced the average amount of rejects to 1 to 2% in recent test runs aggregating several thousand castings, as compared with the usual average of 5 to 10% rejects when using conventional pouring methods.

14-59. The Manufacture of Precision Castings. G. Vennerholm and E. Ensign. *Society of Automotive Engineers Preprint*, 1947, 9 p.

Various methods, with particular emphasis on investment molding. Their applications and limitations.

For additional annotations indexed in other sections, see:

2-12-17; **3**-24-27; **9**-19; **16**-20; **17**-7; **21**-17; **23**-34-45-46-47-48; **24**-43-44; **25**-13-14-16-24; **27**-35-39-42.

15 SALVAGE AND SECONDARY METALS

15-3. Distribution of Ferric Chloride Between Isopropyl Ether and HCl in Stainless Steel Salvaging Process. Ralph McCormack and Frank C. Vilbrandt. *Virginia Polytechnic Institute Engineering Experiment Station Series No. 64*, Sept. 1946, 8 p.

A practical process for production of nickel and chromium salts from stainless steel scrap produced as turnings in small machine shops. The solution of the turnings by HCl was facilitated by addition of $FeCl_3$ and heating. Isopropyl ether is used to extract the $FeCl_3$, hence the distribution study was made.

15-4. Scrap Salvaging. *Steel*, v. 120, Feb. 3, 1947, p. 118.

Sorting, storage and collection of metal scrap in a representative small plant. Recovery of waste oil by oil extractor.

15-5. Disposal of Cyanide Wastes. John G. Dobson. *Metal Finishing*, v. 45, Feb. 1947, p. 78-81.

Cyanide radical which has been found to be toxic to fish in concentrations as low as .025 parts per million can be successfully eliminated from the wastes resulting from plating, case hardening, and other industrial processes by the addition of approximately 4 parts per million of chlorine per part of CN at controlled pH's above 8.5.

(Turn to page 34)

Stress-Rupture Values More Important Than Creep at Very High Temperature

Reported by Wylie J. Childs
Rensselaer Polytechnic Institute

Recently developed compositions of "High-Temperature Alloys", together with the various alloys that have been used in the past, were enumerated in a talk on this subject by C. T. Evans, Jr., chief metallurgist of the Elliott Co., before the Eastern New York Chapter at its December meeting.

Stress-to-rupture and creep curves both give similar results when comparing different alloys. At the higher temperatures the value for stress-rupture drops faster than the curve for creep strength. Consequently when designing for very high temperature service, said Mr. Evans, the effect of creep may usually be neglected, considering only stress-rupture strength.

If fatigue test results are replotted on a basis of time at temperature, rather than number of cycles at temperature, the values appear to be at least as high as those obtained in the stress-rupture test for the same time and temperature. This would indicate that fatigue may not be a limiting factor in some designs at high temperatures.

For long-time service at relatively high temperatures, the older and less expensive alloys such as 25-12 stainless are just as satisfactory as the newer, more expensive alloys. For this reason these materials are still used for applications such as combustion chambers where temperatures above 1600° F. are encountered.

The so-called superalloys probably owe their superior high-temperature properties to carbide or other types of precipitation, according to the speaker. At a temperature of 1800° F., where these precipitates go into solution or coalesce to become ineffective in strengthening the matrix, these alloys are little better than ordinary 25-12 or 25-20.

The German alloys did not possess as good properties as the alloys produced in this country but ingenious design facilitated their effective use.

Nonmachining Uses Of Carbides Shown

Reported by John R. Dobie
Heat Treat Foreman
American Steel & Wire Co.

Feature of the Jan. 8th meeting of the Worcester Chapter was an address by Harry Crump, chief tool sales engineer, Carboloy Co., Inc., Detroit. Prior to his talk, Mr. Crump showed "Everyday Miracles", a new 25-min. sound motion picture dramatizing recent contributions which the hard carbides have made to industrial progress.

Harry Crump

L. P. Tarasov

Mr. Crump's address constituted a review of recent developments in the use of cemented carbides for nonmachining applications, particularly in the field of wear resistance. Slides illustrated such applications as carbide tools for spinning; carbide cooling blocks for tempering razor blade stock; and carbide protected concentricity gages and other checking devices.

An exhibit of various kinds of carbides, carbide tools, and products produced by carbides was on display. Arnold L. Rustay, chapter chairman, presided, and Leo P. Tarasov, research laboratory metallurgist for Norton Co., was technical chairman.

Movie on Welding Released

"Marquette Story" is the title of a new 16-mm. color movie which presents action shots of the construction of Marquette "Instant Arc" welders. Laboratory steps in the formulating and production of Marquette electrodes are seen through the eyes of the camera as well as applications of the welders in scores of industries.

The "Marquette Story" is of 33 min. duration and may be used with any 16-mm. sound projector. It will be loaned free to dealers, schools or interested groups upon request to Marquette Mfg. Co., Inc., Minneapolis 14, Minn., Dept. J-5.

Davis Reviews Aluminum Alloys

Reported by Kenneth O. Uran
Columbian Enameling & Stamping Co.

The January meeting of the Terre Haute Chapter was enlivened by an interesting discussion of aluminum alloys, their development and use. This discussion was led by L. W. Davis of the Aluminum Co. of America, who outlined the composition of most of the commercial alloys now available and described their various characteristics and limitations. An interesting discussion period followed the formal presentation during which many interesting facts and recent developments were brought out.

Toxicity of such cyanide wastes, the various methods of treatment which have been used, and the results of laboratory and plant-scale operations of both the lime-sulphur and chlorination methods.

15-6. Scrap Handling System Paid for Itself in Two Months. Edward F. Sharpe. *Factory Management and Maintenance,* v. 105, Feb. 1947, p. 84-85.

Modern mechanical handling equipment which shows continued savings in labor, money, and floor space.

16 FURNACES AND FUELS

16-13. Simplified Calculation of Radiation From Nonluminous Furnace Gases. W. Trinks. *Industrial Heating,* v. 14, Jan. 1947, p. 40, 42, 44, 46.

The comparatively simple method of calculating the heat transfer from such gases published during the war by Schwiedessen. ("Die Strahlung von Kohlensaure und Wasserdampf" *Archiv für das Eisenhüttenwesen;* October 1940.)

16-14. Economic and Practical Aspects of Electric Hoists for Operating Industrial Furnace Doors. Fred J. Ryan. *Industrial Heating,* v. 14, Jan 1947, p. 48-50, 52, 54.

Advantages of electric door lift and cost comparison with manually operated type.

16-15. Modern Plant Operated by General Heat Treating Co. in Cleveland. *Industrial Heating,* v. 14, Jan. 1947, p. 130-132, 134, 136, 138.

Discussion confined to furnaces.

16-16. The Use of Box-Type Furnaces for Tools. E. F. Watson. *Machinery (London),* v. 69, Dec. 26, 1946, p. 818-819.

Location of heating units in various box type furnaces. Various atmospheres used now and in the past and application of each.

16-17. Heat Treatment. *Automobile Engineer,* v. 36 Dec. 1946, p. 573-582.

Various types of G.W.B. equipment for charging, discharging and quenching furnace loads. An interesting and compact unit for generating a burnt town gas atmosphere is included.

16-18. Oil Firing. G. Reginald Bashforth. *Iron and Steel,* v. 20, Jan. 1947, p. 3-8.

Supply and storage; advantages and disadvantages of oil fuel; heat transfer; characteristics and properties of oil fuel; atomization; burner design; oil and steam flows, as applied to the iron and steel industry.

16-19. Output Increased, Maintenance Reduced in New High-Temperature Furnace. John D. Knox. *Steel,* v. 120, Feb. 3, 1947, p. 99, 122, 124.

Silicon carbide heating tubes and hearth rollers operate at 2500° F. High fuel efficiency obtained. Tubes long in experimental service show no signs of deterioration. Heavy roller loads conveyed through furnace either in batches, by indexing or continuously.

16-20. The Graphite Rod Melting Furnace and Its Many Uses in Foundries. *Brown Boveri Review,* v. 33, April-May 1946, p. 112-114.

It is particularly suitable for foundries where different metals, such as cast iron, aluminum, copper, and copper-nickel alloys are melted in turn.

16-21. Induction and Dielectric Heating. Kennard Pinder. *Electrical Engineering,* v. 66, Feb. 1947, p. 149-160.

Fundamental principles of induction and dielectric heating; various general types of operations utilizing dielectric heating; data on types and sizes of units required.

16-22. Crucible Furnaces. J. G. McDonnell. *Metal Industry,* v. 70, Jan. 31, 1947, p. 83-85.

Lift-out furnaces and tilting furnaces. (To be continued.) (Paper presented to the Slough Branch of the Institute of British Foundrymen.)

16-23. The Use of Heat Baffles on Conveyers of Continuous Furnaces. R. R. Sherrill. *Enamelist,* v. 24, Feb. 1947, p. 11-13, 48-49.

Failure of the hot-zone bottom piers of a new continuous furnace, after three months of operation on Porcelain enameling of stove parts; the use of heat baffles.

16-24. Les Fours Rotatifs de Fusion. (Rotating Melting Furnaces.) (Concluded.) Paul Blanchard. *Fonderie,* no. 10, Nov. 1946, p. 365-374.

Various fuels and refractories used in these furnaces.

16-25. Heat Treating Aircraft Engine Parts at Pratt & Whitney Kansas City Plant. Part I. *Industrial Heating,* v. 14, Feb. 1947, p. 204-208, 210.

Design of furnaces in use. (To be continued.)

For additional annotations indexed in other sections, see: 25-25; 27-32.

17 REFRACTORIES Furnace Materials

17-7. Foundry Refractories—Their Properties and Application. C. A. Brahares. *American Foundryman,* v. 11, Jan. 1947, p. 41-45; discussion, p. 45.

Important properties of the various refractories used in the foundry—their practical meaning to the foundry operator and particular applications.

17-8. Structural Design of Refractory and Heat Resistant Concrete. Part I. Elements of Design. *Industrial Heating,* v. 14, Jan. 1947, p. 116, 118, 120, 122, 124, 126.

Design factors are unit strengths, volume changes and methods of reinforcing. Use of the material in ducts, flues, stacks; combustion chambers; coke oven batteries; heat treating and annealing furnaces; as a structural and a lining material.

17-9. Refractories in Germany. *Refractories Journal,* v. 22, Dec. 1946, p. 400-404.

Basic refractories from serpentine; silica brick; synthetic sillimanite refractories; kyanite-method of production and properties. Information was obtained by means of interviews with German scientists and engineers, and from documents. (Reprinted from British Intelligence Objectives Sub-Committee Report No. 458.)

17-10. Refractory Developments Keep Pace With Industrial Progress. *Brick & Clay Record,* v. 110, Jan. 1947, p. 56, 58, 60, 62.

1946 developments in refractories and their manufacture.

17-11. Comments on the German Refractories Industry as Investigated in 1945. Stuart M. Phelps. *Brick & Clay Record,* v. 110, Jan. 1947, p. 66-68, 70.

Silica refractories were made much like those in this country; basic refractories were no better than ours and some were very inferior. Carbon refractories used almost universally in lower portion of blast furnaces.

17-12. Quartz in Fireclay Refractories. J. Sharp Smith and Peter F. F. Clephane. *Gas Journal,* v. 249, Jan. 8, 1947, p. 91-94.

Test pieces were subjected to heat treatment at various temperatures and for various times up to 28 days. Changes in structure were determined by microscopic examination. Photographs and micrographs. (To be continued.)

17-13. Quartz in Fireclay Refractories. (Continued.) J. Sharp Smith and Peter F. F. Clephane. *Gas Journal,* v. 249, Jan. 15, 1947, p. 156, 159-160, 165, 169.

Study of the behavior of quartz as a major constituent of fireclay brick. Reaction between quartz and clay was found to result in production of glass of low refractory properties. Quartz also reduced thermal shock resistance of the product.

17-14. Annual Report of American Refractories Institute Fellowship at Mellon Institute. Stuart M. Phelps. *American Refractories Institute Technical Bulletin No. 82,* July 1946, 8 p.

Improved test methods and preparation and revision of specifications.

17-15. Tensile Properties of a Sillimanite Refractory at Elevated Temperatures. Alfred E. Kunen, Frederick J. Hartwig and Joseph R. Bressman. *National Advisory Committee for Aeronautics Technical Note No. 1165,* Nov. 1946, 14 p.

Tensile strength, stress-to-rupture characteristics and modulus of elasticity of a sillimanite refractory were investigated at various temperatures from 80 to 1950° F.

For additional annotations indexed in other sections, see: 2-19; 14-51; 16-24.

18 HEAT TREATMENT

18-19. Induction Hardening of Steel. D. L. Martin and R. A. Gehr. *Steel,* v. 120, Jan. 27, 1947, p. 78-80, 82, 84, 86, 89, 107.

Various production fixtures that assure uniformity of product, together with a complete discussion on metallurgical aspects of hardening steel based on the transformation of austenite.

18-20. Heat Treating Aluminum Aircraft Parts in Salt Baths in Woodall Industries Plant. *Industrial Heating,* v. 14, Jan. 1947, p. 56, 58, 60.

Heat treating equipment and procedures.

18-21. Casehardening Wrist Pins With Induction Heat. T. E. Lloyd. *Iron Age,* v. 159, Jan. 30, 1947, p. 54-56.

Casehardening wrist pins by high frequency induction heating with a newly designed 20-kw., 450-kc. unit. Use of this method is expected to permit use of thinner walled pins formed of tubing and to give a production rate in hardening of 1000 2.75-in. long pins per hr.

18-22. New Short-Time Aging Practice for 75S Aluminum Alloy Sheet. J. A. Nock, Jr. and A. C. Wooll. *Iron Age,* v. 159, Jan. 30, 1947, p. 57-59.

A new aging treatment for 75S aluminum sheet which permits the aging cycle to be completed during a single 8-hr. shift. In addition to a saving in time, this practice results in improved formability. Corrosion and corrosion cracking resistance are equal to results obtained by previously used aging practice.

18-23. Production Carburizing. Part II. Lester F. Spencer. *Steel Processing,* v. 33, Jan. 1947, p. 43-50.

Carburized steel considered as two steels in one—the high-carbon case and the low-carbon core. Possible heat treatments following carburizing. Tables show some properties to be expected from carburized steels.

18-24. Controlled Atmospheres From City Gas for the Heat Treatment of Steels. Ivor Jenkins. *Metals Technology,* v. 14, Jan. 1947, T. P. 2121, 58 p.

Design of the gas-generating equipment and experimental investigation of the factors influencing the composition of the gas and of problems in the use of the atmosphere for heat treatment of steels. 26 ref.

18-25. Caustic Soda as a Quenching Medium for Steel. Kenneth Rose. *Mate-*

(Turn to page 36)

Solid Solubility Limits Determine Effectiveness of Alloys on Corrosion

Reported by Dow M. Robinson
Superintendent
New England Metallurgical Corp.

The manner and extent to which corrosion resistance of iron and steel can be improved by the addition of alloying elements, singly and in combination, was clearly demonstrated in an illustrated lecture on "Prevention of Corrosion of Iron by Alloying" at the December meeting of the Boston Chapter ⊕. The talk was given by F. L. LaQue, in charge of the corrosion engineering section, development and research division, International Nickel Co. Technical chairman for the evening was H. H. Uhlig, associate professor of metallurgy at Massachusetts Institute of Technology.

Left: F. L. LaQue, Speaker; Right: H. H. Uhlig, Technical Chairman. (Photo by H. L. Phillips)

As a general rule, Mr. LaQue said, alloying elements are likely to be most effective in improving corrosion resistance of iron only when they are in solid solution. The limit of solid solubility at atmospheric temperatures determines to a considerable extent which elements are added to iron commercially to improve its corrosion resistance. This accounts for the relatively large alloying amounts of chromium and nickel and relatively small amounts of molybdenum, copper and phosphorus. Since the presence of one element may increase the solubility of another, complex alloys may contain larger percentages of some alloying elements. For example, nickel can act as a carrier for substantial amounts of copper and has been used to incorporate silver in chromium-nickel-iron alloys, Mr. LaQue pointed out.

The most important example of elements functioning indirectly in other ways is the influence of small amounts of alloying elements on the protective characteristics of the rusts that form on steels exposed to the atmosphere. The rust that forms on the corrosion resisting steels is not only finer grained, but is darker in color than the rust that develops in common steels.

Mr. LaQue then explained the specific effects of copper, nickel, chromium and molybdenum.

The most important function of copper in steel is to improve resistance to atmospheric corrosion, where a small amount of copper has an amazingly potent effect. In a marine atmosphere it is most effective in a range between 0.005 and 0.05%; there is relatively little improvement as the copper content increases.

Nickel is not likely to be found in ordinary steels in amounts over 2%, although, unlike copper, there is a continuous improvement in corrosion resistance as nickel content increases. The effectiveness of nickel in marine atmospheres is especially important, since copper is relatively impotent in this type of atmosphere. Addition of copper is most effective in the low-nickel steels, probably because once the level of corrosion resistance of a 2.5% nickel steel has been reached, it becomes difficult to improve further the resistance to atmospheric corrosion.

Chromium has a potent effect on resistance of steels to atmospheric corrosion. In a salt atmosphere heavy rusting occurs at 9% chromium and exists in a lighter form up to 18% chromium. This light rusting or superficial staining is prevented by the presence of 8% nickel (the well-known 18-8 composition).

While small amounts of molybdenum are occasionally added to low-alloy steels containing copper or nickel or both, and contribute somewhat to their resistance to atmospheric corrosion and to attack by reducing acids (such as sulphuric and hydrochloric), the principal use of moly in improving corrosion resistance is in connection with the stainless steels. Here it appears to act powerfully in two ways—first, by increasing passivity under mildly oxidizing conditions and, second, by increasing resistance to reducing mediums.

Traces Origin of H-Steels

Reported by Robert J. Johnson
Research Metallurgist
Republic Steel Corp.

Cooperative work by the Society of Automatic Engineers and the American Iron and Steel Institute which resulted in the designation of hardenability bands or H-steels was described by Alfred H. Boegehold, head of the metallurgy department, General Motors Research Laboratories, before the Canton-Massillon Chapter ⊕ on Feb. 5.

Speaking at the chapter's "President's Night", Mr. Boegehold presented his talk on "Correlation of Recent Data on Hardenability". This subject is being presented before a majority of A.S.M. chapters during the current season, and consequently will not be reviewed in detail.

rials & Methods, v. 25, Jan. 1947, p. 75-77.

Effects of concentration and how the process works; what its advantages are.

18-26. Methods of Countering Internal Stresses in Welded Assemblies. G. A. Nikolaev. *Welding*, v. 15, Jan. 1947, p. 37.

Various methods were evaluated. Annealing at 600 to 650° C. was found to be the most effective method. (Abstracted from *Avtogennoe Delo*, no. 10, 1945.)

18-27. Induction Hardening of Steel. Part IV. D. L. Martin and R. A. Gehr. *Steel*, v. 120, Feb. 3, 1947, p. 100-101, 148, 150, 152, 154-155.

Martensite formation and the influence of alloys on hardenability, martensite tempering, internal stresses and quenching cracks. (To be continued.)

18-28. Heat Treating and Machining Magnesium Alloys. Allen G. Gray. *Steel*, v. 120, Feb. 3, 1947, p. 102-104, 106.

Solution, aging and stabilizing heat treating techniques, together with the various factors affecting machining.

18-29. High-Frequency Induction Heating. E. May. *Machinery (London)*, v. 70, Jan. 9, 1947, p. 45-49.

High-frequency power sources; choice of equipment; cost of surface hardening. (To be continued.)

18-30. Modernized Setup Cuts Heat Treat Costs. John G. Gurney. *Iron Age*, v. 159, Feb. 6, 1947, p. 64-67.

Organization of an efficient heat treating layout by a machine tool manufacturer to produce parts economically and high in quality. Methods of cutting costs by saving time and physical energy of workmen, as well as means of obtaining metallurgical uniformity of product. The duties of a clerk-inspector and his importance in promoting efficiency in the heat treating department.

18-31. Some Investigations on the Heat Treatment of Sheet Steel for Cold Pressing. (Concluded.) J. Yourtaieff. *Sheet Metal Industries*, v. 24, Jan. 1947, p. 85-89.

Conclusions regarding soaking time. Normalizing and low-temperature annealing treatment.

18-32. Controlled Heat Treating. *Western Machinery and Steel World*, v. 38, Jan. 1947, p. 90-93.

Equipment and methods employed at Dexter Metal Treating Co.

18-33. Controlled Annealing of Strain Hardened Aluminum Alloys. P. W. Boone and David Lewis II. *Aluminum and Magnesium*, v. 3, Jan. 1947, p. 8, 20.

Partial annealing is entirely practical, and final properties of the material can be closely controlled by proper selection of annealing temperature and time of treatment. Table lists the results of tensile tests on commercial 52S½H aluminum sheet after various annealing procedures.

18-34. Advancements in the Art of Heat Treating Aluminum. James F. Carland and P. R. Watson. *Aluminum and Magnesium*, v. 3, Jan. 1947, p. 9-11, 19, 22.

Some of the interesting and unusual features developed in heat treating installations influenced by more strict temperature control requirements for furnaces, new controls applied to the quenching process and improvements made in the quenching process to minimize distortion of thin sheet stock.

18-35. Liquid Nitriding Increases Tool Life. Geo. A. Roberts. *American Machinist*, v. 91, Feb. 13, 1947, p. 134-136.

Chip pickup and wear on high speed steel tools are materially decreased by nitriding. Taps, chasers, reamers, form tools and broaches are most adaptable.

18-36. Beryllium-Copper Formed Parts; Advantages of Fixture Heat Treatment. *Product Engineering*, v. 18, Feb. 1947, p. 118-121.

Economies in assembled cost of stampings and coil springs possible through the use of fixture heat treated beryllium copper. Proper choice of materials and heat treating cycles. Tolerance ranges possible in fixture heat treated parts.

18-37. Stabilization of 18% Cr, 8% Ni Corrosion Resisting Steel. Samuel J. Rosenberg. *National Bureau of Standards Report No. 8*, Oct. 24, 1946, 6 p.

Results of the ninth and tenth phases of a test program involving study of susceptibility to intergranular attack of test steels as initially cold rolled (37½% cold reduction), followed by different preliminary treatment. Treatments utilized for tests were: Anneal 3 min. at 1975° F., water quench; with and without stabilizing treatment.

18-38. Centres de Cristallisation du Carbone de Recuit de la Malleable a Coeur Noir. (Temper Carbon Nodules Formed by Annealing of Malleable Black-Heart Iron.) Gabriel Joly. *Fonderie*, Nov. 1946, p. 375-385

This paper, based on Russian research, represents an important contribution to the study of factors directly influencing time of annealing. Also describes the factors which influence the number of temper carbon nodules and the manner in which they affect the mechanical properties of the product.

18-39. The Growing Use and Importance of Prepared Atmospheres. E. G. de Coriolis. *Industrial Heating*, v. 14, Feb. 1947, p. 226, 228, 230, 232, 234.

Fields of application of controlled atmospheres, especially in the metal industries. Special reference is made to carbon restoration, prevention of decarburization, gas quenching, dry cyaniding, and dewpoint control. (From a paper presented at the recent American Gas Association Sales Conference on Industrial and Commercial Gas in Toledo, Ohio.)

18-40. Temper Brittleness. W. S. Pellini and B. R. Queneau. *Western Metals*, v. 5, Feb. 1947, p. 52-53.

Development of temper brittleness in two steels of widely different hardenability. Effect of time at temperature in the temper-brittle range determined for both steels. Results obtained by tempering isothermally compared with the embrittlement developed in the steels while cooling or heating through the same range of temperature. (Paper presented before American Society for Metals, November 1946.)

For additional annotations indexed in other sections, see:
3-28-47; **9**-7; **11**-20; **16**-15-17-19-25; **22**-87; **25**-13; **27**-32-37-48.

19 WORKING — Rolling, Drawing, Forging

19-35. Etude sur la Forgeabilité des Alliages Ultra-Légers. (Study of the Forgeability of Extra-Light Alloys.) Paul Bastien. *Métaux Corrosion-Usure*, v. 20, Dec. 1945, p. 155-162.

Magnesium alloys are easily forgeable at temperatures between 250 and 450° C. They are ductile when copper content is not above 15% and aluminum above 9%, and forgeable up to the same copper content. However, aluminum content must then be below 6 to 9%.

19-36. Tungsten Carbide Draw Dies. Richard Saxton. *Metallurgia*, v. 35, Dec. 1946, p. 68-69.

Production of tungsten carbide dies and their design and application in the drawing of metals.

19-37. Steel Mill Production Scheduling. D. I. Brown. *Iron Age*, v. 159, Jan. 30, 1947, p. 60-61.

Efficient scheduling of products and specifications. Takes as an example the scheduling of material on a single bar mill and shows the movement of a backlog of various products, to various specifications and for various customers, from the heat schedule right through to the shipping room.

19-38. Cold Heading Makes Pull Rods Faster. Rupert Le Grand. *American Machinist*, v. 91, Jan. 30, 1947, p. 86-87.

Pull rods, formerly turned on screw machines, are now formed by progressive heading at the rate of 0.2 hr. per 1000 pieces, or 21 times as fast. Further advantage is that the material, S.A.E. 1017 steel, is workhardened at one end by extrusion; thus the difficulty of broaching a normally draggy steel is overcome. Sequence of heading operations.

19-39. Effect of Brake Forming in Various Tempers on the Strength of Alclad 75S-T Aluminum Alloy Sheet. Walter Woods and George J. Heimerl. *National Advisory Committee for Aeronautics Technical Note No. 1162*, Jan. 1947, 4 p.

Effects are summarized, tabulated and charted.

19-40. The Art of Rolling Rounds. Charles P. Hammond. *Iron and Steel Engineer*, v. 24, Jan. 1947, p. 53-64; discussion, p. 64.

The different methods of producing rounds, including details as to practice and equipment used; many diagrams.

19-41. Electrical Control for the New 56-In. Continuous Hot Strip Mill, The Steel Company of Canada, Ltd. D. C. McCrady and W. J. Shortall. *Iron and Steel Engineer*, v. 24, Jan. 1947, p. 110-116.

Some applications of rotating regulators in the control of a modern strip mill.

19-42. Hot Spinning Operations on Heavy Metal Heads. Charles H. Wick. *Machinery (London)*, v. 70, Jan. 2, 1947, p. 3-8.

Modern methods of spinning steel plates, as well as other ferrous and nonferrous metals, into the many types of heads required for various applications.

19-43. Extracting Blanks Automatically. P. D. Aird. *Modern Industrial Press*, v. 9, Jan. 1947, p. 13-14.

Basic principles of the extractor embody the utilization of the vacuum pads of press feeders and a mechanical rack or cradle which performs an operation similar to that of the unloader member of the press crew, only both operations are automatic.

19-44. Forging Die Design. John Mueller. *Steel Processing*, v. 33, Jan. 1947, p. 22-25.

Press forging.

19-45. German Practice in Cold Shaping of Steel. *Steel Processing*, v. 33, Jan. 1947, p. 33-35.

Abstract of report based on investigation made in Germany describing German practice in making bonderized cold steel flow under tremendous pressure to produce extruded steel parts and shapes.

19-46. Automatic Handling of Sheet Metal Stampings. Kenneth Rose. *Materials & Methods*, v. 25, Jan. 1947, p. 131.

Device eliminates manual handling. Ejects large sheets from blanking press automatically. Steel is fed through the side of the press, the strip is blanked and the blank is removed from the press and moved into straightening rolls without any manual handling whatever.

19-47. Hot Rolling Iron-Carbon Alloys. Part I. E. Piwowarsky and A. Wittmoser. *Iron Age*, v. 159, Feb. 6, 1947, p. 52-57.

Investigations conducted in Germany to establish the effect of various factors on the hot rolling of high-test iron in an effort to determine the feasibility of producing piston rings from rolled cast iron. Influence of chemical composition, initial structure, thermal condition and rate of reduc-

(Turn to page 38)

Gas Quenching and Skin Recovery Explained by Heyn

Reported by W. G. Poor

W. Wirt Young & Associates, Inc.

Gas quenching, gas pickling, atmosphere forging, skin recovery and malleableizing were included among the "Practical Applications of Prepared Atmospheres" described before the January meeting of the New Haven Chapter by Henry M. Heyn of Surface Combustion Corp. Mr. Heyn was introduced by Lloyd E. Raymond, technical chairman.

The speaker used slides to illustrate the importance and effect of water vapor. A nitrogen atmosphere which is dry to the equivalent of −40° F., containing about 0.013% of water vapor, has been commercially produced and applied. How important this is is indicated by the fact that even as small an amount of air as one volume admixed with 100 volumes of dry gas would raise the dew point to +30° F., a difference sufficient to change a neutral gas to one which has a pronounced decarburizing reaction.

Atmosphere gas quenching, Mr. Heyn said, has many possibilities where rates faster than air cooling and slower than oil quenching are necessary to produce required physical properties, along with clean, bright metal surfaces.

The "skin recovery" process is used to restore carbon to decarburized steel surfaces by the principle of carbon pressure balance. Using a controlled atmosphere of the desired carbon potential, carbon is transferred from the atmosphere to the decarburized steel surface until a carbon balance is obtained, when the process stops automatically. The carbon is added above the initial amount established by the carbon potential of the atmosphere. By maintaining the carbon potential of the furnace atmosphere, not only can carbon be restored, but surface decarburization can be prevented.

Many possibilities are seen for the use of atmosphere heating in forging thin steel parts where precise dimensions along with freedom from scaling, surface irregularities and decarburization are advantageous. Mr. Heyn showed slides of a rotary indirect-heated furnace for forging hollow propeller blades.

Chapters Plan Joint Meeting

A joint meeting of the St. Louis and Missouri School of Mines Chapters will be held at Rolla, Mo., on April 26. Open house in the metallurgy building on the campus is planned from 1:00 to 2:45 p. m. At three o'clock A. W. Schlechten, chairman of the metallurgy department, will lecture on "The Production of High-Purity Zirconium Metal". Both chapters are arranging for additional speakers for the afternoon and evening sessions.

Metallic Atoms in Action To Be Tri-Chapter Theme

Reported by R. E. Christin

Columbus Bolt Works Co.

Theme of the all-day Ohio Tri-Chapter Meeting, to be held on April 24, will be "Metallic Atoms in Action". The meeting will be in Columbus, with the Dayton and Cincinnati Chapters cooperating.

Starting with plant visits in the morning, the program will include a luncheon at the Fort Hayes Hotel at noon, followed by two technical sessions, one at 2:00 p.m. and the second at 4:00 p.m. A dinner and speaker at 6:30 p.m. will wind up the day's events.

Tentative speakers are John Chipman of Massachusetts Institute of Technology, who will discuss atomic metallurgy, Dr. Poole of Ohio State University, who will describe and show colored movies of the bomb tests at Bikini, and E. E. Thum, editor of *Metal Progress*, who will discuss the humanitarian aspects of the atomic bomb. Charles Lucks of Battelle Memorial Institute, chairman of the Columbus Chapter, will preside as general chairman of the meeting, and Walter Hobbs, Columbus vice-chairman, will be in charge of program arrangements.

PLEASE NOTE!

NAMES AND ADDRESSES of the magazines and journals annotated in the Review of Current Metal Literature are available in list form from ASM headquarters. Use this list if you wish to secure a copy of any original article, and write direct to the source. Copies of the address list may be secured free of charge by writing to Metals Review, 7301 Euclid Ave., Cleveland 3, O.

tion. Literature on subject. (To be continued.)

19-48. The Rolling of Metals: Theory and Experiment. Part XIII. (Continued.) L. R. Underwood. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 73-84, 90.

Torque, deformation work and rolling horsepower. 51 ref.

19-49. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 95-99.

Mechanical breakdowns; advantages and disadvantages of pneumatic cushions; control of the air in pneumatic cushions; essential features of the circuit; pressure setting and tools; an assembly precaution. (To be continued.)

19-50. The Use of Rubber Buffers for Press Cushioning. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 101-102.

Takes issue with certain parts of article by J. A. Grainger in September 1946 issue, and author's reply.

19-51. Metal Bellows. *Metal Industry,* v 70, Jan. 24, 1947, p. 69-70.

Production from deep drawn tubes. Advantages of the process employed.

19-52. Influence of the Speed of Deformation Upon the Resistance of Metals to Plastic Deformation. L. D. Sokolov. *Engineers' Digest (American Edition),* v. 4, Jan. 1947, p. 22-24.

Lead, copper, and five alloy steels were investigated. Results tabulated, charted, and summarized. (Condensed from *Journal of Technical Physics* (U.S.S.R.), v. 16, 1946, p. 437-441.)

19-53. The Prevention of Fatigue Failures in Metal Parts by Shot-Peening. J. G. Brookman and L. Kiddle. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 23,* Dec. 1946, 14 p.

Theoretical basis governing the use of shot-peening is presented, particular reference being paid to Almen's work, and the problems of distortion, complimentary stresses, and stress concentrations. Factors necessary in a specification for peening include the selection of areas, coverage, shot type, shot size and intensity. New method for measuring intensity. Practical applications of the treatment and the possibility of obtaining large increases in life.

19-54. Hot Rolling Iron-Carbon Alloys. Part II. E. Piwowarsky and A. Wittmoser. *Iron Age,* v. 159, Feb. 13, 1947, p. 63-65.

Adverse effect of graphite in high-carbon gray iron on the mechanical properties of hot rolled iron. Roll design and the feasibility of employing rolled cast iron for piston rings.

19-55. Ball-Pen Tubular Parts Rotary-Sliced to Length. John W. Dean, Jr. *American Machinist,* v. 91, Feb. 13, 1947, p. 108-110.

How burrs and distortion are defeated by rotary knives that quickly cut gold, gold-filled and steel tubing for pen and pencil bodies and caps.

19-56. The Versatile Press Brake. John E. Hyler. *Tool Engineer,* v. 18, Feb. 1947, p. 44-46.

Present and potential applications of the press brake in bending, straightening, forming, multiple punching.

19-57. The Welded Steel Press. Albert Clements. *Steel,* v. 120, Feb. 17, 1947, p. 90-91, 112.

Rigidity and lateral stiffness inherent in welded construction meets all requirements. Box-type columns of generous width hold crown and bed in line even under excessively eccentric loading.

19-58. Threads Made by Stamping Process. *Product Engineering,* v. 18, Feb. 1947, p. 97.

Method effective where close accuracy is not required. Effects 50% saving. Technique illustrated.

19-59. Production Processes, Their Influence on Design. Part XX. Impact Extrusion. Roger W. Bolz. *Machine Design,* v. 19, Feb. 1947, p. 115-119.

Advantages of the process; pressures required; Hooker process; design of parts; punch strength; materials; tolerances. (Reprints of the first 15 parts of this series are now obtainable from *Machine Design's* Book Dept.)

19-60. New Gravity Drop Hammer Features Pneumatic Ram Lift. *Iron Age,* v. 159, Feb. 20, 1947, p. 47.

New tool which promises to expand the usefulness of the gravity drop hammer, cut down forging time and reduce the time required for adjustment and repair.

19-61. A Brief Summary of the Report Made to the Combined Intelligence Objectives Sub-Committee Regarding the Westfalische Drahtindustrie, Hamm, Germany. *Wire and Wire Products,* v. 22, Feb. 1947, p. 139-140.

Report gives information regarding the extent of plant for manufacture of miscellaneous wire products and its condition at the time the inspection was made; the equipment, practices, research, records, and the character of the products.

19-62. Effect of Spacing Between Dies in the Tandem Drawing of Tubular Parts. George Sachs and George Espey. *Transactions of the American Society of Mechanical Engineers,* v. 69, Feb. 1947, p. 139-143.

The importance of a sufficiently large spacing when drawing tubular parts with a tandem-die arrangement.

For additional annotations indexed in other sections, see:

8-18; **12**-26; **18**-31-36; **21**-18; **22**-61-99; **23**-28-32-42-43; **24**-39; **25**-19-24; **26**-23; **27**-41.

20 MACHINING AND MACHINE TOOLS

20-53. Mass Production of Electrical Shavers. *Philips Technical Review,* v. 8, Oct. 1946, p. 309.

Photograph shows how the 48 slots are cut in the head of the "Philishave" dry shaver.

20-54. The Machining of Continuous Cast Bronzes. J. B. Jilbert. *Screw Machine Engineering,* v. 8, Dec. 1946, p. 53-55.

Turning, boring and cutting off; drilling; reaming; tapping; milling; and broaching. Proper feeds and speeds.

20-55. Screw Machine Engineering Data Sheet. *Screw Machine Engineering,* v. 8, Dec. 1946, p. 57.

Table gives number of revolutions necessary to reduce work to required diameter and length of cut at given feed per revolution.

20-56. Manhurhin Automatic Lathes. *Screw Machine Engineering,* v. 8, Dec. 1946, p. 69-74.

Specifications and details of fixed spindle type PF and automatic turret type TR.

20-57. Broaching Matches Golf Irons Within 1/16 Oz. *American Machinist,* v. 91, Jan. 30, 1947, p. 90-91.

Complete sets of irons are now being produced by broaching, and precision of the club head as to shape and weight is controlled by the machine and the setting of the fixtures.

20-58. Practical Ideas. *American Machinist,* v. 91, Jan. 30, 1947, p. 109-116.

Disk eccentrics drive key-seating fixture. Toolpost grinder trues straightedges. Adjustable center drill cuts to accurate depth. Setscrew wrench. Built-up snap gages are simple and economical. Feedscrew and taper shank improves lathe tapping. How to shift a center. End pressure holds lenses securely against faceplate. Center the screw on inside calipers. Don't make form cutters too complicated. Small plastic blocks clamped with vacuum chuck. Nonmarking shoe. Adjustable gage sorts round stock accurately. How to align shafting through a wall. Wiggler. Geared fly cutter has built-in feed. Milling machine clamps. Expanding screwdriver. Storage cabinets protect the hydrolap machine rings. Broach a square hole to remove a broken bushing. Crayon marking simplifies gage re-inspection.

20-59. Machining of Stainless Steels. W. H. Crisp and W. Burnan. *Machinery (London),* v. 70, Jan. 2, 1947, p. 9-13.

Recommendations for production of holes and threads using high speed steel tools.

20-60. Clamps for Jigs and Fixtures. W. H. Litten. *Machinery (London),* v. 70, Jan. 2, 1947, p. 14-16.

Further uses of the lever and other types of clamps previously discussed.

20-61. Hints on Grinding and Polishing. *Sheet Metal Worker,* v. 38, Jan. 1947, p. 135-136, 182.

Tables give recommended speeds in feet per minute for wheel tips, classification of abrasives, and revolutions per minute to provide wheel tip speeds indicated. Notes on abrasive wheel choice and polishing procedures.

20-62. A New Method of Spacing for Hole Drilling. T. C. Du Mond. *Materials & Methods,* v. 25, Jan. 1947, p. 72-74.

The "Man-Au-Trol", a device which provides for automatic spacing of holes according to a predetermined layout. How it works and what its advantages are.

20-63. A Handy Bending Fixture. Robert Mawson. *Materials & Methods,* v. 25, Jan. 1947, p. 131.

Problem was solved of meeting the two dimensions on the legs of cutting pliers, after the parts had been assembled and hardened.

20-64. Machine Tools. *Russian Technical Research News,* v. 1, no. 5, 1947, p. 2-3.

Survey of recent developments and outline of current research. References.

20-65. New Standard on Tool Life. O. W. Boston. *Steel,* v. 120, Feb. 3, 1947, p. 112, 115-116, 162, 164.

Methods for determining cutting-speed tool-life relationship; factors involved in finding tool life in facing tests based on increasing speed. Other data pertinent to the expected performance of cutting tools.

20-66. Duplicating Cam Surfaces. *Machinery (London),* v. 70, Jan. 9, 1947, p. 44.

Quick and simple method of duplicating cam surfaces on a surface grinder.

20-67. Buick Cylinder Blocks Now Machined on First Unitized Transfer Line. Joseph Geschelin. *Automotive and Aviation Industries,* v. 96, Feb. 1, 1947, p. 20-27, 62.

Floor plan shows the integration of the block machine line from start to finish. Each of the machines in the line is a self-contained and automatic unit connected to the next operation by a short length of gravity roller conveyer. Sequence of operations.

20-68. Machining Wrought Aluminum Alloys. E. R. Yarham. *Modern Machine Shop,* v. 19, Feb. 1947, p. 164-166, 169, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 197, 198, 200.

Experiences of some of the leading British companies.

20-69. How Many Teeth in a Carbide Cutter? Carl LeMay. *Modern Machine Shop,* v. 19, Feb. 1947, p. 204, 206, 208.

Steel milling with carbides and determination of the optimum number of teeth that a carbide cutter should have for the best results. Provides a simple and practical method of selection

(Turn to page 40)

Cincinnati Has President's Night

At Cincinnati Chapter's President's Night Are (Left to Right) A. P. Fischer, Chapter Secretary; W. A. Maddox, Vice-Chairman; National President A. L. Boegehold, J. F. Kahles, Chairman; and S. T. Olinger, Treasurer

Reported by Kurt Siems
Cincinnati Milling Machine Co.

The January meeting of the Cincinnati Chapter was dedicated this year to the sustaining member companies of the chapter and to the president of the American Society for Metals, A. L. Boegehold, head of metallurgy department, General Motors Corp. Following an excellent dinner served "home style" at the Engineering Society of Cincinnati, and preceding the president's lecture, John A. Lloyd, vice-president of Union Central Life Insurance Co., Cincinnati, gave a coffee talk on "Present Economic Trends". As an ex-newspaper editor, three-term state senator and former superintendent of insurance of the State of Ohio, he spoke with authority and authenticity.

Mr. Boegehold's announced talk on "Correlation of Recent Data on Hardenability" has been presented to a large number of other A.S.M. chapters. A lengthy discussion period following his talk was possibly the best proof of the value of the address.

Broadening Applications Of Low-Alloy Steels Seen

Reported by R. B. Miclot
Lunex Co.

Low-alloy steels during the past 15 years have been gaining a wide and diversified use in railroad and other industries, James W. Halley told members and guests at a joint meeting of the Tri-City Chapter ⊛, The American Society of Civil Engineers, and the American Society of Mechanical Engineers. Mr. Halley, who is chief research engineer of the Inland Steel Co., Chicago, spoke on the qualities of "Low-Alloy High-Strength Steels".

These steels were initially prepared to manufacture light-weight railway cars, the speaker stated. He discussed their average properties of strength, weldability, impact, and atmospheric corrosion resistance. In comparing the low-alloy steels with carbon steels for certain applications, even though the cost is higher, savings are gained in lighter weights, increased life, and for the same climatic conditions, better resistance to rusting.

Ladish Changes Name

Ladish Drop Forge Co. of Cudahy, Wis., has announced that the corporate name has been changed to Ladish Co. The new name will remove the limitations implied by "drop forge".

based upon practices currently in use in industry.

20-70. Ideas From Readers. *Modern Machine Shop*, v. 19, Feb. 1947, p. 216, 218, 220, 222, 224, 226.

Magnet aids in solving transmission problem. Spin dimpling tool. Dust collector for belt sander. Fixture to hold thin parts for drilling.

20-71. Micromatic Hone. *Fortune*, v. 35, Feb. 1947, p. 84-89, 154-156, 158-159.

The story of Micromatic Hone Corp. and the special tools which they make.

20-72. Broaching. E. Percy Edwards. *Automobile Engineer*, v. 37, Jan. 1947, p. 27-31.

Machine selection, broach design and broach material. Recommendations are also made concerning broaching speeds and cutting fluids. The importance of fixture design is stressed, and short descriptions are given of machines for broaching cylinder heads and cylinder blocks. (Extracts from paper presented to the Institution of Production Engineers.)

20-73. Machining Magnesium Alloys. Allen G. Gray. *Steel*, v. 120, Feb. 10, 1947, p. 100-102, 111-112.

Special techniques for various machining operations including turning and boring, shaping, planing, milling, drilling.

20-74. Free-Machining Die Steel. *Steel*, v. 120, Feb. 10, 1947, p. 104.

A medium carbon steel having sufficient alloy content to provide air hardening properties may be machined in hardened state. At hardness greater than 300 Brinell, it is only slightly more difficult to machine than fully annealed steels used for same purpose.

20-75. Production Robots Cut Machining Costs. *SAE Journal*, v. 55, Feb. 1947, p. 42-44.

Fundamentals of transfer machine operation and important considerations in transfer machine design. Unusual features of recent installations. Why this machine makes possible great savings in labor and time and even in tooling costs. (From "Transfer Machines—Robots of Production", by J. H. Mansfield.)

20-76. Comparison of Crush Dressing and Diamond Dressing as Applied to Thread Grinding. E. V. Flanders. *Mechanical Engineering*, v. 69, Feb. 1947, p. 123-127.

Results of a series of comparative tests made to evaluate the two methods. Advantages and disadvantages of each method. A decision between the two methods must be based on consideration of the job to be done.

20-77. Practical Ideas. *American Machinist*, v. 91, Feb. 13, 1947, p. 141-148.

Worm wheel milling without centers. Permanent face plate "dog" simplifies shaft turning. Piloted tap aids line tapping. Wire loop and proper oil improves steadyrests. Special steadyrest holds small cylindrical work. Portable coolant system serves many machines. Swinging arm slots screwheads in drill press. Inset-disk cutters give long tool wear. Shaper head in lathe chuck permits boring. Bent screw checking methods. Templet guides tapered helix cutting tool. Two spring winders. Hand bending fixture for light strip stock. Half twist improves quarter-turn belt drives. Bent leg inside mike reaches around boring bar. Blended radius form tool eliminates shoulders.

20-78. High Production on a Single Component. *Production Engineering & Management*, v. 19, Feb. 1947, p. 63-64.

Parts processed are mine hoist drums. Operation consists of turning and grooving the outside diameter of the drum and turning the flanges to size. Machining operations.

20-79. Exacting Manufacture of Parts Accelerated With Ingenious Tools. *Production Engineering & Management*, v. 19, Feb. 1947, p. 66-74.

Equipment and procedures in producing parts for watches at Elgin National Watch Co.

20-80. Machine and Tool Engineering. *Production Engineering & Management*, v. 19, Feb. 1947, p. 75-77.

Rapid Setup for Irregular Parts by George W. Ingham; Production Drilling on a Lathe by Robert Mawson; Threads Cut on Radial Drill by H. E. Richardson.

20-81. Spring-Steel Clutch Plates Require Unusual Operations. Charles H. Wick. *Machinery*, v. 53, Feb. 1947, p. 139-145, 165.

Some of the innovations and unusual operations in setup at Buick Motor Division of the General Motors Corp.

20-82. Operations in the Production of Electronic Tube Components. *Machinery*, v. 53, Feb. 1947, p. 160-164.

Unusual operations performed in the manufacture of rotating anode assembly for X-ray tubes. Among these are tungsten-reinforced copper casting; machining of stainless steel bushings to a wall thickness of only 0.012 in.; glass-to-metal sealing; silver soldering by induction heating in a vacuum; and metallic lubrication of ball bearings.

20-83. Ingenious Mechanisms. *Machinery*, v. 53, Feb. 1947, p. 187-189.

Mechanism for interrupting a feeding device at adjustable predetermined positions. Method developed for bonding plastics to metals.

20-84. Tool Engineering Ideas. *Machinery*, v. 53, Feb. 1947, p. 191-194.

Precision turning on small drilling machines. Universal boring-bar holder designed especially to obtain rigidity. Unusual lathe setup for making model propellers from a master.

20-85. Fundamentals and Applications of Carbide Milling. A. O. Schmidt. *Tool Engineer*, v. 18, Feb. 1947, p. 31-35.

The application of thermodynamic principles to metal cutting. Tool life and rate of production are increased by choosing correct speed rather than the highest possible speed. Also negative rake tools last longer. Advantages and disadvantages of chromium plating of carbide cutters.

20-86. Drilling and Boring Tools. *Tool Engineer*, v. 18, Feb. 1947, p. 47-48.

Types of drill jigs and fixtures, and their construction.

20-87. How to Use Carbide Cutters for Milling. Parts I and II. H. A. Frommelt. *Iron Age*, v. 159, Feb. 13, 1947, p. 44-49; Feb. 20, 1947, p. 48-53.

General concept of carbide milling with special emphasis on cutter angles and power requirements. Application of carbides to the milling of low-carbon steels. Problem of the built-up edge, and information on the most suitable cutting and clearance angles with specific examples of milling boiler plate, S.A.E. X1020, wrought iron and low-carbon steel. Speeds and feeds; the K-land and K-factor.

20-88. Influence on Tool Life and Power of Nose Radius, Chamfer, and Peripheral-Cutting-Edge Angle When Face-Milling a 40,000-Psi. Cast Iron. O. W. Boston and W. W. Gilbert. *Transactions of the American Society of Mechanical Engineers*, v. 69, Feb. 1947, p. 117-124.

Results obtained in studying the effect on tool life, nature of tool wear, and power requirements when varying successively the nose radius, width of chamfer at 45° from the cutter face, and the peripheral cutting-edge angle in face-milling cast iron.

20-89. Results of an Investigation of the Removal of Metals by the Process of Grinding. R. E. McKee, R. S. Moore and O. W. Boston. *Transactions of the American Society of Mechanical Engineers*, v. 69, Feb. 1947, p. 125-129.

The influence of grinding wheels, grinding compounds, and other pertinent factors on the process of cylindrical grinding.

20-90. Can This Part Be Made in One Setup on an Automatic Screw Machine? *Screw Machine Engineering*, v. 8, Feb. 1947, p. 40-44.

Part referred to is a small item used in I.B.M. machines. It consists of a shaft with one end rounded, tapered, and bent to a slight curve; and having a six-tooth gear as an integral part, near the center of the shaft. How I.B.M. engineers solved the machining problem.

20-91. Engineering Short Cuts for Screw Machine Departments. Part II. C. W. Hinman. *Screw Machine Engineering*, v. 8, Feb. 1947, p. 45-47.

Simple fixture permits quick and accurate measuring of cams in either the engineering department or at the machine on which the cam is to be used.

20-92. Designing Tools for Screw Machine Production. *Screw Machine Engineering*, v. 8, Feb. 1947, p. 53-56.

Circular-tool step corrections.

20-93. Vibration Vs. Precision in Single Point Boring Tools. A. W. Ehlers. *Tool & Die Journal*, v. 12, Feb. 1947, p. 68-70.

Development and application of press-fitted boring-bar extension cap of dissimilar metal which resulted in sufficient vibration dampening to permit an increase of boring bar length: diameter ratio to 5:1 for working cast iron and 5½:1 for aluminum.

For additional annotations indexed in other sections, see:
3-51; **11**-14; **12**-25-29; **18**-28; **23**-27-52; **24**-38-64.

21 LUBRICATION and Friction; Bearings

21-14. Ball Bushings. Lloyd H. Leonard. *Steel*, v. 120, Jan. 27, 1947, p. 74-75, 116.

Designed for round shafts, new unit provides advantages of low rolling friction with unlimited oscillating linear travel. Basic operating principle involves use of a series of balls rolling in continuous oblong tracks which supply necessary recirculation.

21-15. Metal Powder Self-Lubricating Bearings. A. J. Langhammer. *Iron and Steel Engineer*, v. 24, Jan. 1947, p. 93-95; discussion, p. 95-97.

In the oil-cushion bearing, the factors of gravity, pressure, etc., which in a solid bearing are a liability, cause the oil film to be generated and established. They operate under the principles of hydraulics rather than mechanics. Available in various sizes and designs and for many purposes.

21-16. Aluminum Alloys for Bearings. H. Y. Hunsicker and L. W. Kempf. *SAE Quarterly Transactions*, v. 1, Jan. 1947, p. 6-29; discussion, p. 29.

Tests on a number of aluminum alloys for antiscoring qualities, fatigue resistance, and mechanical stability in operation. Optimum bearing characteristics are found in alloys having a plastic, low-melting phase and a relatively hard phase uniformly distributed throughout an aluminum solid solution matrix of moderate hardness. Tin furnishes the best plastic constituent. Addition of silicon forms a hard constituent which increases strength markedly. Aluminum-tin-silicon-copper alloy, the most successful aluminum bearing alloy yet developed, may be used in centrifugal castings for large-size bearings or in pressure die castings and sheet for small thin-walled bearings. Manufacturing costs are low because of good machining

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Round Tables on Three Subjects Held at Saginaw

Reported by V. E. Hense
Metallurgist, Buick Motor Division

Three timely subjects—carburizing, light metals, and toolsteel—were discussed simultaneously at the Jan. 21st meeting of the Saginaw Valley Chapter at Frankenmuth, Mich.

The discussion of carburizing was led by F. E. Harris, furnace engineer, Buick Motor Division, G.M.C., with N. Nichols of Saginaw Steering Gear Division, G.M.C., as technical chairman. Mr. Harris's introductory talk covered the theory of diffusion of carbon in austenite and ferrite. He also discussed the application of the iron-carbon equilibrium diagram to carburization and decarburization.

J. C. Smith of the American Magnesium Corp. led the discussion on light metals, and A. M. Lennie of the Dow Chemical Co. acted as technical chairman. Mr. Smith gave a brief talk showing various applications of aluminum and magnesium alloys in marine and construction industries. He supplemented his talk with slides showing applications.

Toolsteel discussion was headed by George Roberts, Vanadium-Alloys Steel Co., with Thomas King of Buick Motor Division, G.M.C., as technical chairman. The talk was centered around the proper choice of toolsteels for particular applications and showed several ways to determine the proper choice of toolsteels for the job. He recommended eliminating unnecessary and duplicated specifications and suggested reducing them to a maximum of nine steels for most shops.

Talk on Organic Metallics Covers Wide Field of Uses

Reported by W. S. Lienhardt
General Superintendent
Metal & Thermit Corp.

A distinct variation from the usual type of program was held by the Calumet Chapter when L. T. Work, director of research and development, Metal & Thermit Corp., addressed the January meeting on "Organic Metallics".

Dr. Work covered the wide field of metal compounds—both inorganic and organic—their chemical structure, manufacture, and applications. Applications of the inorganic metallic compounds were described in the fields of plating, fireproofing and ceramics. Discussing the organic compounds, Dr. Work talked about the more common ones, such as lead tetraethyl, the silicones and various tin organics which are becoming of increasing importance.

Hardness Ranges For Springs Given

Reported by R. B. Miclot
Lunex Co.

A display board of several hundred kinds of springs served to illustrate a talk on "Springs and Spring Materials" presented by Otto R. Hills, chief engineer of the William D. Gibson Co., Division of the Associated Spring Corp., Chicago, before the Tri-City Chapter of the American Society for Metals at a recent meeting.

Mr. Hills' company stocks 50 different types of materials for springs and handles some 8000 sizes. There are various methods of manufacturing springs, he pointed out, and then went on to discuss spring mechanics, heat treatment, pressing operations, and hardness ranges necessary to maintain best spring quality and still avoid the high brittle range in plain carbon and alloy steels.

Many flat springs are made from annealed stock and then heat treated. Desired hardnesses are shown in the tabulation below:

Spring Material	Rockwell Hardness
Plain carbon steel	C-44 to 48
Chromium-vanadium steel	C-46 to 48
Silicon-manganese steel	C-49 to 53
Silicon-chromium steel	C-50 to 54
High speed steel	C-55 to 59

characteristics and the high speed with which the material can be cut and finished.

21-17. How to Pour Bearings. K. T. MacGill. *Western Machinery and Steel World,* v. 38, Jan. 1947, p. 94-95.

Fundamentals for the guidance of shop men in pouring babbitt in relatively small quantities.

21-18. Drawing Compounds Improve Press Potentials. Sam Spring. *American Machinist,* v. 91, Feb. 13, 1947, p. 117-128.

What happens when sliding metal surfaces contact under high pressures. Friction, welding, composition and application of modern drawing lubricants, chemical and physical tests suitable for production shops and recommendations for specific metals.

21-19. Trends in Development and Application of Cutting Fluids. J. T. Beard, Jr. *Transactions of the American Society of Mechanical Engineers,* v. 69, Feb. 1947, p. 131-137; discussion, p. 137-138.

The influence that various metals have upon the types of cutting fluids which are used, and especially on the role played by the hardness and cutting qualities of metals. Various groups of cutting tools, the influence of design of machine tools and the new nonpetroleum grinding compounds.

21-20. Selecting the Proper Cutting Fluid. *Iron Age,* v. 159, Feb. 20, 1947, p. 46.

Charts of cutting fluids for drilling, machine reaming, and tapping.

For additional annotations indexed in other sections, see:
6-37-38-40; 20-82; 27-49.

22 WELDING
Flame Cutting; Riveting

22-57. Penetration and Welding Speed in Contact Arc Welding. P. C. van der Willigen. *Philips Technical Review,* v. 8, Oct. 1946, p. 304-308.

Advantages in welding technique and economy obtainable with the new type of electrodes, which were described in a recent article by the author.

22-58. Furnace Brazing Steel Insecticide Bombs. Allen T. Cole and H. M. Webber. *Steel,* v. 120, Jan. 27, 1947, p. 70-73, 110, 113-114.

Plant in which entire layout for fabricating 10,000 containers per 8-hr. day is planned around two roller hearth copper brazing furnaces. Principle of straight-line flow is maintained by belt and roller conveyers through assembly, bonding, testing and inspecting processes.

22-59. Kitchen and Bathroom Units for Prefabricated Houses. *Machinery (London),* v. 69, Dec. 26, 1946, p. 811-817.

Complete kitchen unit, with heater to warm living room and hot water system, is backed by complete bathroom fixtures. Welding operations on the linen cupboard, and main assembly jig for the cupboard.

22-60. Fixtures Make Welders Flexible. Part III. Ed Reilly. *American Machinist,* v. 91, Jan. 30, 1947, p. 84-85.

Loading devices, rotating fixtures and gun welders, which, when combined, speed fabrication of many commercial units.

22-61. Resistance Welders Mass-Produce Containers. *American Machinist,* v. 91, Jan. 30, 1947, p. 104-105.

Pictures with brief descriptions show how complex 18-gage steel containers are made at a rate of 220 per hr., by forming and resistance welding rather than deep drawing.

22-62. Recommended Spot Welding Procedures. Frederick S. Dever. *Iron Age,* v. 159, Jan. 30, 1947, p. 46-50.

Suggestions for design. Preparation, equipment and inspection for spot welds in aircraft structures.

22-63. Some Notes on Inert-Arc Welding. R. F. Wyer. *Sheet Metal Worker,* v. 38, Jan. 1947, p. 137-138.

The process and its application to various metals.

22-64. Welding Machine Maintenance at Ryan Aeronautical Company. C. A. Lehton and H. F. Worcester. *Western Metals,* v. 5, Jan. 1947, p. 26-28.

Systematic methods for maintenance and lubrication. Maintenance costs have been reduced approximately one-third because repairs and adjustments become evident before they can take on large proportions. Greater utilization of plant machinery and more economical operation of production tools have been realized.

22-65. New Oxygen-Arc Process for Cutting Ferrous and Nonferrous Alloys. H. R. Clauser. *Materials & Methods,* v. 25, Jan. 1947, p. 78-81.

The "Oxyarc" process, its applications and advantages. An arc is established between the work and a coated tubular rod, through which oxygen flows. The cutting is accomplished by the combination of melting from the high-temperature arc and the oxidation reaction.

22-66. Spot Weld Quality on Low Carbon Steel. J. J. Riley. *Steel Processing,* v. 33, Jan. 1947, p. 36-39.

Hundreds of welds were made using different combinations of weld time, electrode force, and welding current. Results were correlated to develop equations and tables for predicting weld quality (tensile shear strength) from the above factors, and others such as thickness of the work and size of the weld.

22-67. Letter to the Editor. J. F. Lincoln. *Steel Processing,* v. 33, Jan. 1947, p. 40-41.

President of Lincoln Electric Co. objects to emphasis placed on inspection of welds for porosity, undercutting, etc. He says that, regardless of such defects, the weld is usually stronger than the adjacent metal.

22-68. Heat Distribution Around the Welding Arc. N. N. Rykalin. *Engineers' Digest (American Edition),* v. 4, Jan. 1947, p. 16-18.

Deals with three ideal cases from a mathematical point of view. These are: a point source of heat traveling over a solid body; a linear source of heat traveling over a thin plate; and a laminar source of heat traveling along a rod of small cross section. Effect of arc movement is shown graphically. Theoretical calculations agree well with measurements. (Condensed from *Avtogennoe Delo,* no. 2, 1946, p. 6-11.)

22-69. Welded Construction of a Drop-Shaped Container for Liquid Fuel. *Engineers' Digest (American Edition),* v. 4, Jan. 1947, p. 44.

New design of 123,000-cu.ft. tank recently erected in France and method of erection. Condensed from *Le Genie Civil,* v. 123, Nov. 1, 1946, p. 298.)

22-70. Air Pressure Speeds Automatic Welding. *Steel,* v. 120, Feb. 3, 1947, p. 97, 144, 146.

Application involves high air pressure up to 1000 psi. to control sequences in fast, automatic multispot resistance welding. A second development is a storage battery-powered machine that provides excessive power needed for flash welding aluminum.

22-71. San Francisco's Own Resistance Welders. Ralph G. Paul. *Western Machinery and Steel World,* v. 38, Jan. 1947, p. 86-89, 110.

Theoretical considerations influencing design of equipment for resistance welding.

22-72. Spot Welding Technique. Frederick S. Dever. *Western Machinery and Steel World,* v. 38, Jan. 1947, p. 100-105.

Experiences at Ryan Aeronautical Corp. on design, selection of material, preparation of parts, and equipment.

22-73. Economics of Arc Welding. J. A. Dorrat. *Welding,* v. 15, Jan. 1947, p. 2-10.

Factors which determine the economic application of welding. Material preparation, design, electrode size, welding current, duty cycle and joint accuracy from an essentially practical standpoint.

22-74. Resistance Welding in Mass Production. A. J. Hipperson and T. Watson. *Welding,* v. 15, Jan. 1947, p. 11-24.

Suitability of the different processes for various materials and types of joints.

22-75. Maintenance of Arc Welding Plant. E. W. Harding. *Welding,* v. 15, Jan. 1947, p. 25-28.

Practical information regarding the care of arc welding plant. Recommendations should help to save both time and money.

22-76. Oxygen Cutting. Part VII. E. Seymour Semper. *Welding,* v. 15, Jan. 1947, p. 29-33.

Latest type of equipment and technique; appropriate operating data.

22-77. Method of Restoring the Wobblers of Cast Iron Rolls. I. D. Kuzema, A. I. Serpokrylov, and V. S. Aristov. *Welding,* v. 15, Jan. 1947, p. 37.

Machinable gray cast iron was deposited using cast electrodes, the composition of which is given. Also describes mechanical setup. (Abstracted from *Avtogennoe Delo,* no. 10, 1945.)

22-78. Gas Welding of Aluminized Steel. G. N. Kulakova. *Welding,* v. 15, Jan. 1947, p. 37.

Composition of a flux which gave good results. (Abstracted from *Avtogennoe Delo,* no. 10, 1945.)

22-79. Glass-to-Metal Joints. J. H. Partridge. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 119-128.

Techniques employed for glass-to-metal seals made by direct fusion. Some examples of the two classes of joints and data for the thermal expansion of the glass and metal and the maximum stress in typical joints.

22-80. The Development and Improvement of Spot Welding Electrodes. G. F. James. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 159-166.

Application of copper alloys in the manufacture of electrode tips. Principal aim was to determine optimum welding conditions for several types of copper alloy electrodes. Effects of electrode tip diameter and life were studied and considerable work was done on the evaluation of the effects of hardness, annealing at various temperatures and resistance to wear.

22-81. The Welding of Nonferrous Metals. (Continued.) Part VIII. E. G. West. *Sheet Metal Industries,* v. 24, Jan. 1947, p. 167-172.

Welding of copper and its alloys. (To be continued.)

22-82. The New Brown Boveri Automatic Arc Welding Head. *Brown Boveri Review,* v. 33, April-May 1946, p. 107-111.

A machine for bare-wire electrode welding. Principle used not only insures exact control and simplicity of use but also reliable operation, attained by avoiding the use of auxiliary gear and mechanisms. Control is entirely automatic, the winding being completely enclosed.

22-83. Heliarc Welding. R. J. Anderson. *Canadian Metals & Metallurgical Industries,* v. 10, Jan. 1947, p. 14-21.

The welding torch; power requirements; typical applications. Tables give recommended welding current values.

22-84. Weldability of Malleable Cast Iron. T. J. Palmer. *Transactions of the Institute of Welding,* v. 9, Dec. 1946, p. 183-188.

Examines the various factors involved in order to explain why this material is not amenable to welding, particularly fusion welding.

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New Western Ontario Chapter Receives Charter From Trustee Focke

Reported by W. L. Barkey
Spramotor Limited

Presentation of the chapter charter to Howard J. Wright, first chairman of the newly formed Western Ontario Chapter of the American Society for Metals, was formally made at the first meeting of the group in London, Ont., on Jan. 31. Arthur E. Focke, A.S.M. national trustee, presented the charter and addressed the chapter on "The Metallurgist, the A.S.M., and the Metal Industry".

Dr. Focke, who is chief metallurgist, Diamond Chain and Mfg. Co., Indianapolis, Ind., gave a brief history and outline of the society's objectives. He credited chapter organization with making it possible for members great distances from the central offices to get just as much out of the A.S.M. as members close to the headquarters city.

The basic purpose of the society, he said, is to educate all its members by means of lectures, courses of instruction, and publications, by specialists in every field of the metal industry. It is important, he continued, to teach a man how to teach, for a man who is unable to pass on the knowledge he has accrued is a loss to society and industry.

In accepting the charter, Mr. Wright traced the history of the organization of the chapter. Thousands of tons of metal are produced annually in the London area, he pointed out, and 90% of it is consumed in western Ontario.

A. B. Lawrason, chairman of the Ontario Chapter, which is now in its 27th year, also welcomed the new group and offered any help that the parent body could give.

Howard J. Wright, First Chairman (Left), Accepts the Charter of the New Western Ontario Chapter From National Trustee Arthur E. Focke

Promoted by Ryerson

C. D. D'Amico has been named manager of the special steels department at the Los Angeles plant of Joseph T. Ryerson & Son, Inc. He will be in charge of sales of both alloy and stainless steels.

Mr. D'Amico is a graduate of Wayne University and received his Ph.D. from University of Michigan. He has had practical experience in a variety of producing and consuming positions—at Rich Manufacturing Corp., Standard Oil Co. of California, Pacific States Steel Corp., Vulcan Steel Foundry Co. and Joshua Hendy Iron Works.

Active in metallurgical circles on the West Coast, Mr. D'Amico is vice-chairman of the Golden Gate Chapter and is also vice-chairman of the General Committee for the Western Metal Congress, currently in session in Oakland, Calif.

Claud S. Gordon Promotes Manka

Vincent Manka, for the past three years general sales manager for the Claud S. Gordon Co., Chicago, has been appointed vice-president.

Comparisons of Jet Engine And Gas Turbine Made

Reported by Kurt Siems
Cincinnati Milling Machine Co.

With an authority on turbo-jet engines as speaker for its December meeting, the Cincinnati Chapter sponsored a joint meeting with the Engineering Society of Cincinnati and the Cincinnati Section of the American Society of Mechanical Engineers. Speaker was H. J. Clyman, assistant to manager, engineering department, aviation gas turbine division, Westinghouse Electric Corp., and his subject was "The Aviation Gas Turbine of Today and Tomorrow".

Mr. Clyman related in considerable detail the history of the gas turbine, with special emphasis on the development of the axial flow aircraft gas turbine as marketed by Westinghouse, and the meteoric advances made during the war in design improvements, weight reduction and performance efficiency in these engines. Principles of operation along with materials used in construction were explained.

Other illuminating data were revealed on a German engine of similar design. This information had been obtained by Mr. Clyman as a member of an Army Technical Investigating Mission to that country.

Performance and efficiency comparisons between straight jet-type engines, geared gas turbine propeller engines, and conventional reciprocating motors as we know them today showed that each one of these three types of power plants has its own definite sphere of operation in which it works to better advantage and with greater efficiency than either of the other two.

J. R. Vilella Speaks on Metallographic Technique

Reported by W. E. Borin
Metallurgist, Underwood Corp.

Speaking on his favorite subject, "Metallographic Technique for Steels", J. R. Vilella of the United States Steel Corp. Research Laboratory at Kearny, N. J., presented his excellent collection of slides before the January meeting of the Hartford Chapter.

Mr. Vilella systematically reviewed the fundamentals involved in photomicroscopy with emphasis on the preparation of specimens and the correct use of the optical system.

In explaining each of his photomicrographs, the speaker pointed out several common sources of error and resulting incorrect interpretations. Meanwhile, in the light of his own excellent technique, he pointed out the obsolescence of the words "troostite" and "sorbite".

Lounsberry New Tech. Dir. Of Allegheny Ludlum

Frank B. Lounsberry has been named vice-president and technical director of Allegheny Ludlum Steel Corp. to succeed Vere B. Browne, who is retiring after 38 years with the company. Mr. Lounsberry, whose former title was vice-president in charge of methods and processes, had been associated with the Atlas Steel Co., Dunkirk, N. Y., and remained with this company through its merger with the Ludlum Steel Co. and the Allegheny Steel Co.

F. B. Lounsberry

V. B. Browne

Mr. Lounsberry has announced several new appointments for Allegheny Ludlum. Laurence C. Hicks will be assistant director of research. John H. Crede will succeed Dr. Hicks as associate director of research in charge of magnetic steel and allied products; Claude M. Sheridan has been appointed associate director of research in charge of stainless steel and allied products; and William J. Baldwin has been appointed chief plant metallurgist at the Watervliet, N. Y. plant.

22-85. Welding Builds Stainless-Steel Kettles. Clyde B. Clason. *Welding Engineer*, v. 32, Feb. 1947, p. 39-43, 72.
Equipment and procedures employed by Groen Mfg. Co.

22-86. Hitting Trouble Before It's Due. C. A. Lehton and H. F. Worcester. *Welding Engineer*, v. 32, Feb. 1947, p. 49-51.
How a planned preventative maintenance program has eliminated shutdowns and reduced by one-third the costs of keeping welding equipment in order.

22-87. R-F Heating—and Why It Works. B. E. Rector. *Welding Engineer*, v. 32, Feb. 1947, p. 52-54.
Nontechnical explanation of what radio-frequency heating is and how it is used for brazing and hardening.

22-88. Welding in the Cement Industry. Aubrey Smith and Walter J. Campbell. *Welding Engineer*, v. 32, Feb. 1947, p. 62-65.
Examples of application of welding as a means of building new equipment and keeping existing equipment in perfect operating condition.

22-89. Powder Cutting and Scarfing. D. H. Fleming. *Welding Engineer*, v. 32, Feb. 1947, p. 66-70, 113.
How use of a metallic powder provides a versatile process capable of handling a wide variety of alloy compositions from ingot form to finished product.

22-90. All-Welded Sheaves. T. W. Ling. *Welding Engineer*, v. 32, Feb. 1947, p. 72.
Three pieces of steel are welded together in the same manner as a fabricated wheel or gear from a hub, web and rim.

22-91. Welding Sheet Metal for Enameling. Orville F. Barnett. *Finish*, v. 4, Feb. 1947, p. 17-19, 56, 58.
Two separate approaches suggested for eliminating the spalling of enamels.

22-92. Metal-to-Metal Adhesives. Thomas D. Perry. *Plastics*, v. 6, Feb. 1947, p. 26, 28-29, 85-87.
Charts, tables, and description give properties of metal-to-metal joints made using "Redux", a phenol-formaldehyde adhesive.

22-93. Repair Maintenance Fabrication in the Plant Weldery. Meat Packing Plant. *Industry and Welding*, v. 20, Feb. 1947, p. 40-41, 83-86.
Equipment and operations in a meat packing plant.

22-94. Taking Stock of Resistance Welding. Part II. John E. Ponkow. *Industry and Welding*, v. 20, Feb. 1947, p. 44-45, 92-93.
New techniques in the spot welding of aluminum and galvanized material.

22-95. Automatic Welding Corrosion Resistant Metals. R. J. Anderson and H. J. Roberts. *Industry and Welding*, v. 20, Feb. 1947, p. 48-50, 52, 54.
New procedures for welding copper, nickel, monel, nickel-clad, the stainless alloys and 4 to 6% chromium steel.

22-96. Molybdenum Steel Riveting. *Iron Age*, v. 159, Feb. 13, 1947, p. 49.
Device has been used successfully in the assembly of turbine blading for the riveting of the blades to diaphragms. Employs tungsten-carbide tip shrouded in a molybdenum steel cup.

22-97. Handling Is the Answer in Welding Loco Boilers. *American Machinist*, v. 91, Feb. 13, 1947, p. 106-107.
Procedures at American Locomotive Co. at Schenectady.

22-98. Magnetic Templet Tracing Increases Accuracy of Shape-Cutting. *Product Engineering*, v. 18, Feb. 1947, p. 92-96.
Single blowpipe accuracy of ± 0.010 in. and four-blowpipe accuracy to ± 0.0150 in. are claimed for the Oxweld Type CM-41 machine.

22-99. Welded Steel Tubing Improves Truck Body Construction. *Product Engineering*, v. 18, Feb. 1947, p. 99.
Standard sizes of square and rectangular steel tubing are welded to form custom truck bodies. Steel body is claimed to be 25 to 30% lighter and 50% stronger than the wooden type.

22-100. Assembly of Aluminum Parts by Furnace and Dip Brazing Methods. A. H. Peterson. *Product Engineering*, v. 18, Feb. 1947, p. 115-117.
Design details for aluminum parts to be joined by furnace or dip brazing methods. Use of jigs, self-positioning assemblies, tack welding and riveting to hold assemblies during brazing. Cleaning and corrosion protection of brazed assemblies.

22-101. Flux-Injection Cutting Stainless Steels. Part I. G. E. Bellew. *Steel*, v. 120, Feb. 17, 1947, p. 86-88, 115.
Injected directly into the cutting-oxygen stream, flux chemically removes obstructing oxides to expose fresh base metal to the cutting jet in this latest process of severing stainless. Fundamentals, capacities, and advantages of the methods. (To be continued.)

22-102. Dual Joining Method. *Steel*, v. 120, Feb. 17, 1947, p. 104-105.
Method employed by fabricator of steel igloos for Navy's reserve fleets. Fasteners and welding "team" to seal half spheres protecting guns against atmospheric attack.

22-103. Electric Arc Welding of Copper-Base Alloys. H. Hose. *Machinery*, v. 53, Feb. 1947, p. 178-181.
Recommended procedures for joining silicon bronze, beryllium copper, aluminum bronze, and brasses of various compositions.

22-104. Automatic Arc Welding Boosts Tank Production. *Production Engineering & Management*, v. 19, Feb. 1947, p. 78, 80.
Automatic welding, supplemented by clever jigs and fixtures, reduces actual welding time on tanks to one quarter of that required for manual welding.

22-105. Welding Fixtures for Mass Production. Part III. A. E. Rylander. *Tool Engineer*, v. 18, Feb. 1947, p. 27-30.
"Merry-go-round" consists of a ring running on a circular track. The work moves to the machine and away from it, on a single belt conveyer, with one operator loading and unloading. Eight welders, disposed in staggered position inside and outside the conveyer, produce at the rate of 240 completed assemblies per hour. Front cross bar of an automobile frame used as assembly example.

22-106. Induction Soldering Speeds Production. *Electronic Industries & Electronic Instrumentation*, v. 1, Jan. 1947, p. 3.
How technique is applied to production of stainless steel kitchen utensils at Adel Precision Products Corp., Huntington, W. Va.

22-107. New Development in Blind Riveting. *Western Metals*, v. 5, Feb. 1947, p. 38-39.
New rivets utilize a new upsetting technique. Each rivet is an assembly of two parts—a special hollow body with a hole drilled through it, and a stem, assembled in the hole. The rivet is upset in the work by pulling the stem through the rivet with a pneumatic or manual gun. When the stem is pulled, it forces the shank of the rivet to expand and completely fill the hole in the work. Needs just one operator. Other production economies.

For additional annotations indexed in other sections, see:
3-24-51; 6-29; 12-28; 18-26; 20-82-83; 23-31-32-33-37-38-44-49-51; 24-35-40-45-58; 25-13-27; 27-46.

23 INDUSTRIAL USES and Applications

23-23. Progress in the Tin-Consuming Industries. John Ireland. *Metallurgia*, v. 35, Dec. 1946, p. 97-100.
Review is limited to the past two years. Progress directed to tin conservation; the newer uses are exemplified by the application of tin to steel as a pretreatment for paint, electrodeposited tin-zinc alloys as a new protective coating for steel, and flux degassing in bronze manufacture as the avenue to a range of high-quality alloys with greatly improved mechanical and corrosion resistant properties.

23-24. Zinc and Its Alloys. B. Walters. *Metallurgia*, v. 35, Dec. 1946, p. 101-103.
The changeover from wartime to peacetime conditions has affected the various uses of zinc; certain more recent applications of the metal.

23-25. The Use of Isotopes as Tracers. A. H. W. Aten, Jr. and F. A. Heyn. *Philips Technical Review*, v. 8, Oct. 1946, p. 296-303.
Possible uses in metallurgical field are: checking the amount of phosphorus in molten steel; checking mercury vapor concentration in air; checking the extent of solution of alloy additions to metals; study of transfer of minute quantities of metal from one surface to another as a factor in friction or lubrication studies. Numerous additional applications to varied fields are discussed briefly.

23-26. Nonferrous Copper Wire for Moving-Coil Meters. P. G. Moerel and A. Rademakers. *Philips Technical Review*, v. 8, Oct. 1946, p. 315-319.
The material for the rotating system of moving-coil meters sometimes contains particles of iron. Their ferromagnetism combined with inhomogeneity of the magnetic field causes defects in the measuring instrument. Measures are discussed for keeping the copper wire used for the moving coil as free of iron as possible.

23-27. The Manufacture of Fish Hooks. *Machinery (London)*, v. 69, Dec. 26, 1946, p. 822-824.
Operations in various stages of their production. Special machinery used.

23-28. Double-Wall Tubing. *Steel*, v. 120, Jan. 27, 1947, p. 76, 120-121.
Double-wall tubing made of nickel or monel combines high ductility and other mechanical properties with corrosion resistance. Bonded joints cannot be separated at temperatures under melting point of base metal.

23-29. Magnesium Bathinette. L. M. Oldt. *Modern Metals*, v. 2, Jan. 1947, p. 15.
13-lb. unit utilizes extruded magnesium tubing in the main framework. Members are joined together by a slot and key arrangement.

23-30. Aluminum Architectural Uses Broadening. E. V. Sharpnack. *Modern Metals*, v. 2, Jan. 1947, p. 16-18.
Rural applications are expanding rapidly, residential uses multiplying and aluminum has distinct industrial appeal.

23-31. Sandwich Materials: Metal Faces Stabilized by Honeycomb Cores. W. W. Troxell and H. C. Engel. *Society of Automotive Engineers, Inc., Preprint*, 1947, 12 p.
General advantages and disadvantages of balsa wood and honeycomb. Information pertaining to sandwich constructions having 24S-T alclad aluminum alloy faces and a particular type of honeycomb core, the structure being bonded by one particular adhesive.

23-32. Experiences of an Aircraft Manufacturer With Sandwich Material. H. B. Gibbons. *Society of Automotive Engineers, Inc., Preprint*, 1947, 12 p.
(Turn to page 46)

Carrier Gas to Control Surface Carbon In Carburizing Described by de Coriolis

Reported by E. M. Sherwood
Metallurgist, Sperry Gyroscope Co., Inc.

Practical aspects of gas carburizing were featured by E. G. de Coriolis, director of research of Surface Combustion Corp., in a talk on "Furnace Atmospheres as Applied to Carbon Control" before the New York Chapter.

Early applications of gas to carburizing made no attempts to remove the deposited carbon black resulting from the catalytic breakdown of hydrocarbons such as methane, according to Mr. de Coriolis. When this operation was conducted in a tumbling barrel type of retort, the mechanical action kept the metal surfaces clear of deposited carbon so that fresh incoming gas could continue the reaction between the carbon in the gas and the exposed steel surface. If no tumbling took place, the steel surface would promptly coat with a layer of carbon which became impervious to the action of gases and hence tended to arrest carburizing.

The first attempts made to carry on the operation in a pusher-type retort consisted in adding to the carbonaceous gas in the muffle a carrier gas containing enough carbon dioxide to react with the deposited carbon on the surface of the steel, thus freeing it from excessive carbon and allowing fresh portions of carbonaceous gas to contact the steel surfaces. This method met with a good deal of success by making it possible to carburize a wide variety of steel parts. Nevertheless control of surface carbon was extremely difficult because a rather close balance had to be kept between the decarburizing effect of the carbon dioxide of the carrier gas and the carburizing effect of the carbonaceous gas introduced to the muffle.

More recently a carrier gas has been developed made by catalytic cracking of a closely held ratio of air and carbonaceous gas resulting in a mixture that is approximately 40% nitrogen, 40% hydrogen and 20% carbon monoxide. To this mixture is added a small percentage (seldom exceeding 10%) of a carbonaceous gas such as natural gas; this is introduced into various portions of the muffle or the laboratory of a radiant tube furnace in which the carburizing operation is conducted.

The 40-40-20 gas mixture actually contains a slight amount of water vapor; by controlling the percentage of the water vapor it is possible to control the carbon concentration on the surface of the steel. Mr. de Coriolis also mentioned a dew point recorder recently developed which accurately determines the percentage of moisture in such gases and facilitates manipulation.

Promoted by Bausch & Lomb

I. L. Nixon

L. B. McKinley

Ivan L. Nixon, instrument sales manager for Bausch & Lomb Optical Co., Rochester, N. Y., since 1932, has been named manager of the instrument division. He has been with the company since 1907. His successor as instrument sales manager is J. Lysle McKinley, who joined Bausch & Lomb in 1923. He became Mr. Nixon's assistant less than a year ago.

Georgia Chairman Named President of Atlantic Steel

R. S. Lynch, chairman of the Georgia Chapter, has been elected president and a member of the board of directors of the Atlantic Steel Co., Atlanta, Georgia. Mr. Lynch has been previously associated with the American Sheet & Tinplate Co., United Alloy Steel Corp., Republic Steel Corp., and Rigid-Tex Corp. He joined the staff of the Atlantic Steel Co. in Sept. 1944 as vice-president.

R. S. Lynch

While with Rigid-Tex Corp. Mr. Lynch was instrumental in developing a special rolled alloy which was used in connection with the radio proximity fuse during the war; he was recently cited by the U. S. Navy for his outstanding development work on this specialized project. During the past year Mr. Lynch served on the National Nominating Committee.

Advantages of Dies Made of Hot Melt Plastics Enumerated

Reported by R. H. Olmsted
Technical Assistant
Farrel-Birmingham Co., Inc.

The almost unbelievable variety of items, colors and shapes that can be made from waste material of cottonseed oil mills was spectacularly shown in a colored talking picture "Careers for Cellulose" in New Haven on Nov. 14. The film served as supplementary illustration to a talk by W. O. Bracken, assistant product supervisor, cellulose product department, Hercules Powder Co., Wilmington, Del., on "Tools and Dies for Plastics and Plastic Jigs and Fixtures".

The occasion was a combined meeting of the New Haven Chapter and the New Haven Section of the American Society of Tool Engineers.

Since a given molding powder company may have hundreds of formulations of a given single material such as cellulose acetate, it is highly important that toolmen know their materials and applications, Mr. Bracken pointed out. The three general fields of plastics in the tool industry are for tool handles and parts, tool packages, and casting plastics for tools to be used in hydro-press and punch press work.

Although he discussed many examples of applications in each of these fields, outstanding uses were for such items as screw driver handles, hot melt stripping compounds for protecting tools from corrosion during shipping and for protecting cutting edges of tools during handling, and finally for drop hammer punches, double action dies, jigs, and forming blocks. Some of the advantages of dies, made of hot melt plastics in comparison with those made of lead, for instance, are light weight, low die inventory (they can be broken up, remelted and recast), equalized pressure in stamping, no necessity for fitting, and suitability for forming easily cracked metals such as magnesium.

Movie Shows Material Handling

A new movie on material handling, "Payloads Pay Off", has been released by the Institute of Visual Training. It will be distributed through the facilities of both the Institute, whose headquarters are 40 East 49th St., New York, and the Automatic Transportation Co., 149 West 87th St., Chicago.

A three-reel, 26-min., black and white sound picture, it features Gregory Abbott, chief commentator for Paramount Newsreel, as narrator. It was filmed with the cooperation of General Electric Co., at whose Pittsfield, Mass., works much of the action was photographed.

$2000 Welding Prizes Offered

Two thousand dollars in cash prizes will be awarded in 1947 by the Resistance Welder Manufacturers' Association, for outstanding papers dealing with resistance welding subjects, according to announcement of the contest. Judges will be appointed by the American Welding Society, and awards will be made at its 1947 fall meeting.

The contest will close on July 31, 1947. Information on requirements for submission of papers should be requested from the American Welding Society, 33 W. 39th St., New York 18.

Sandwich material is known as "Metalite", faces of which are normally made of high-strength aluminum alloy and the core of a low-density balsa wood. Found advantageous to arrange the balsa with the grain of wood normal to the metal faces. A two-stage bonding operation is employed. In the first stage Cycleweld C-3 cement is cured on the metal faces only. Final bonding of the faces to the core is accomplished with a medium temperature phenolic resin adhesive. This material is fabricated into a few elemental shapes, illustrating flat, single and double curvature forming. Experience with the sandwich material.

23-33. Philosophy for Design of Sandwich Type Structure. John F. Korsberg. *Society of Automotive Engineers, Inc., Preprint*, 1947, 7 p.
Requirements of this type of structure for aircraft. Testing procedures, and current and proposed research programs in this field at Boeing Aircraft.

23-34. Bardco Manufacturing & Sales Company. *Western Metals*, v. 5, Jan. 1947, p. 18-21.
Story, in pictures with explanatory notes, of the various operations in foundry, machine shop and final assembly for manufacture of motor-generator sets and gates and valves for irrigation systems.

23-35. Aluminum Advances on All Fronts. Fred P. Peters. *Scientific American*, v. 176, Feb. 1947, p. 63-65.
Its economic advantages, increased strength, the new clads and some of the other alloys; possibility of wide application.

23-36. Santa Fe Stainless Steel Refrigerator Car Is Placed in Test Service. *Railway Age*, v. 122, Feb. 1, 1947, p. 273-275.
Illustrated article describes new 40-ton car.

23-37. Pools of Steel. Alden Stahr. *Steel Construction Digest*, v. 4, Jan. 1947, p. 10-11.
Use of welded steel for home swimming pools. (Reprinted from *American Home*.)

23-38. Welded Steel-Plate Axlebox: L.M.S. Railway. *Engineering*, v. 163, Jan. 10, 1947, p. 43.
New construction of axlebox used on British railway.

23-39. Factory-Built Aluminum Houses. *Machinery (London)*, v. 70, Jan. 9, 1947, p. 35-44.
Factory arrangements and press operations in two British factories.

23-40. Aluminum Luggage. Erle P. Halliburton, Jr. *Western Machinery and Steel World*, v. 38, Jan. 1947, p. 74-77, 111.
All operations, from raw stock to finished product.

23-41. Air Skiff by Douglas. *Western Machinery and Steel World*, v. 38, Jan. 1947, p. 78-80, 112.
Assembly procedures for aluminum boat.

23-42. Oakland Transformer Plant. *Western Machinery and Steel World*, v. 38, Jan. 1947, p. 82-85.
How transformers are made. Design; fabrication of wire for coils; assembly of coil forms, steel core, and other parts.

23-43. Aluminum Tucker "Torpedo". *Aluminum and Magnesium*, v. 3, Jan. 1947, p. 15, 20.
Automobile has bumper and grill of heat treated aluminum. Doors and rear and front deck panels also made of stamped sheet aluminum. Suspension members are aluminum forgings as are the housings on the hydraulic disk type brakes. Steel is retained as the major component in the chassis, the welded tubing frame, the one-piece top and the fenders.

23-44. Welded Dragline Booms of 150-Ft. Length. H. Gottfeldt. *Transactions of the Institute of Welding*, v. 9, Dec. 1946, p. 189-203.
Development of boom used for strip mining of coal in Britain. Structural design details.

23-45. The Heat's On. *Die Castings*, v. 5, Feb. 1947, p. 17, 31.
Details of an assembly which includes a constant level valve, safety trip mechanism, and a large-capacity, easily cleaned strainer, housed in a corrosion resistant zinc-alloy die casting. Deep intersecting tubular passageways are part of the reason for die casting the housing of this valve for oil burning equipment.

23-46. A Sound Investment. *Die Castings*, v. 5, Feb. 1947, p. 18-20, 35.
Story of part which die castings have played in making the wire recorder economically practical for domestic consumption.

23-47. Some Cost Reduction Factors in Typewriter Design. *Die Castings*, v. 5, Feb. 1947, p. 26-28, 30.
Costs are compared between three gray iron typewriter components and the aluminum die castings which replaced them.

23-48. Thread-Cutting Screws in Die Castings. Harbison Meech. *Die Castings*, v. 5, Feb. 1947, p. 52, 54, 56, 58.
How these screws eliminate manufacturing operations, simplify assembly, and improve fastening.

23-49. Welded Piles for a Pier. Henry Schutz. *Welding Engineer*, v. 32, Feb. 1947, p. 44-45.
A type of steel pile, fabricated by welding H-beams.

23-50. Performance of the New Alnico Permanent Magnet Materials. F. W. Merrill. *Electrical Manufacturing*, v. 39, Feb. 1947, p. 72-77, 182, 184, 186.
After an analysis of permanent magnet theory, the suitability of the newer Alnico alloys, for either fixed or variable air-gap apparatus, is discussed through interpretation of their demagnetization curves.

23-51. Use of Steel Forms for Concrete House Production. Walter J. Brooking. *Iron Age*, v. 159, Feb. 13, 1947, p. 57-62.
Weld fabrication of the steel house forms, method of setting up the forms, pouring of the monolithic structure, and some of the unusual prime movers used in the production process.

23-52. New Methods Aid Volume Output of Industrial Engines. G. C. Robechaud. *Production Engineering & Management*, v. 19, Feb. 1947, p. 55-58.
How generous use of die-cast components, processed with special purpose tools and fixtures, has effected a reduction in weight and cost of industrial gasoline engines at the new West Coast plant of McCulloch Motors.

23-53. Metal Printing. C. W. Dickinson. *Steel*, v. 120, Feb. 17, 1947, p. 112.
Development of offset metal printing, its present and potential applications.

23-54. Electronics Speeds up Today's Factory Jobs. *Electronic Industries & Electronic Instrumentation*, v. 1, Jan. 1947, p. 2-3.
Applications in production of bulldozers at Caterpillar Tractor Co.

23-55. Tools and Techniques for Truck-Trailer Production. Fred M. Burt. *Tool Engineer*, v. 18, Feb. 1947, p. 18-26.
Operating sequences, with some coverage of the manufacture of the huge carryalls and special units at Fruehauf Trailer Co. of California. Straight-line flow and continuity of movement are major factors in efficiency.

For additional annotations indexed in other sections, see:
3-30; 5-14; 12-28; 14-44; 20-82; 22-59-99-106; 24-60; 25-13-15-16; 27-38.

24 DESIGN

24-32. Compressive Strength of 24S-T Aluminum-Alloy Flat Panels With Longitudinal Formed Hat-Section Stiffeners. Evan H. Schuette, Saul Barab, and Howard L. McCracken. *National Advisory Committee for Aeronautics Technical Note No. 1157*, Dec. 1946, 15 p.
Results tabulated and charted.

24-33. Column and Plate Compressive Strengths of Aircraft Structural Materials. Extruded 0-1HTa Magnesium Alloy. George J. Heimerl and Donald E. Niles. *National Advisory Committee for Aeronautics Technical Note No. 1156*, Jan. 1947, 9 p.
Strengths were determined both within and beyond the elastic range from tests of flat-end H-section columns and from local-instability tests of H, Z, and channel-section columns.

24-34. Effect of Rivet or Bolt Holes on the Ultimate Strength Developed by 24S-T and Alclad 75S-T Sheet in Incomplete Diagonal Tension. L. Ross Levin and David H. Nelson. *National Advisory Committee for Aeronautics Technical Note No. 1177*, Jan. 1947, 10 p.
Shear stresses on the cross section were nearly constant for all values of the rivet factor investigated if the other properties of the web were not changed.

24-35. Reinforcement of Branch Pieces. (Concluded.) J. S. Blair. *Engineering*, v.162, Dec. 20, 1946, p. 577-581; Dec. 27, 1946, p. 605-606.
Appendices giving more detailed information concerning an extensive investigation of various designs for reinforcement of welded steel pipe branches. They include details of test methods used; strength test results on horseshoes and rings used for reinforcement; calculations used in design of "triform" type of reinforcement; and four examples.

24-36. Strength Testing Douglas DC-6. Milton A. Miner. *Automotive and Aviation Industries*, v. 96, Jan. 15, 1947, p. 22.
Some of the special equipment and techniques used in static testing of the completed plane before test flight.

24-37. Electrical Resistance Wire Strain Gages to Measure Large Strains. K. H. Swainger. *Nature*, v. 159, Jan. 11, 1947, p. 61-62.
"Minalpha" wire supplied by Johnson Matthey (British firm) was compared with several other wires for use in the type of strain gage using fine metal filaments stuck to a paper base. Results show that, by using "Minalpha" wire with an unstrained joint, the range of the resistance wire strain gages is quadrupled. The composition of the wire is not given.

24-38. Designing Tools for Screw Machine Production. *Screw Machine Engineering*, v. 8, Dec. 1946, p. 64-67.
Illustrations with explanatory notes.

24-39. Designing of "Trouble-Free" Dies. Part LXV. C. W. Hinman. *Modern Industrial Press*, v. 9, Jan. 1947, p. 18, 44.
Compressed air applications.

24-40. Design and Fabrication of Welded Magnesium Tanks for Aircraft. R. J. Cross. *Light Metal Age*, v. 5, Jan. 1947, p. 8-15.
Comprehensive treatment covers design for structural stability and for minimizing corrosion; welding design and technique; correcting distortion; sheet metal standards; final finishing.

24-41. Photographic Reproduction as an Engineering Tool. Dyche E. Clark. *Iron Age*, v. 159, Feb. 6, 1947, p. 60-63, 121.
Use of photographic reproductions for cutting costs and speeding various phases of manufacturing operations. Techniques and equipment used in

(Turn to page 48)

CHAPTER MEETING CALENDAR

CHAPTER	DATE	PLACE	SPEAKER	SUBJECT
Baltimore	April 21	Engineers' Club	R. E. Crawford	The Supersonic Reflectoscope
Birmingham District	April 1		L. W. Vollmer	Quenching Oils and Quenching
Boston	April 11	Hotel Sheraton	A. Dudley Bach	The Surface Hardening of Steel
Buffalo	April 10		Alfred L. Boegehold	Correlation of Recent Data on Hardenability
Calumet	April 8	Phil Smidt and Son, Whiting, Ind.	P. H. Girouard	Naval Ordnance
Canton-Massillon	April 21	Elks Club, Canton	G. A. Roberts	Die and Tool Steels
Cedar Rapids	April 8	Hotel Roosevelt	W. J. Jackel	Weldability of Air Hardening Steel
Chicago	April 10	Chicago Bar Association	R. W. Auxier	The Properties of Plastic Laminates
Cincinnati	April 24	Fort Hayes Hotel, Columbus		Tri-Chapter Meeting
Cleveland	April 7	Cleveland Club	E. S. Bunn	Extrusions
Columbus	April 24	Fort Hayes Hotel		Metallic Atoms in Action (Tri-Chapter Meeting)
Dayton	April 24	Fort Hayes Hotel, Columbus		Tri Chapter Meeting
Des Moines	April 8	Iowa State College, Ames, Iowa		Powdered Metals
Detroit	April 14	Rackham Building	E. F. Barker	Physics of Metals
Eastern New York	April 8	Circle Inn, Lathams	A. A. Burr	Spectrographic Analysis
Fort Wayne	April 14	Chamber of Commerce	Robert Gillette	Resistance Welding
Georgia	April 7			Labor Relations
Hartford	April 8	Hartford Gas Co.	John C. McDonald	Designing With Magnesium
Indianapolis	April 21	Marott Hotel	Wilbur Shaw	
Kansas City	April 16	Pine Room	E. Dale Trout	X-Ray Inspection
Lehigh	April 4	Hotel Bethlehem	L. S. Bergen	Precision Castings—Their Applications and Limitations
Los Alamos	April 14		F. G. Tatnall	Strain Gages and Testing Methods
Los Angeles	April 24	Southern Calif. Gas Co. Auditorium	P. D. McElfish	Metallurgy in Oil Refining
Mahoning	April 18	(Joint Meeting A. W. S.)	L. C. Bibber	Various Welding Processes
Milwaukee	April 15	City Club	Howard L. Gerhart	Recent Developments in Plastics
Missouri Sch. of Mines	April 26	Rolla, Mo.	A. W. Schlechten	Production of High-Purity Zirconium (Joint Meeting with St. Louis Chapter)
Montreal	April 7	Queen's Hotel	C. R. Whittemore	Precision Casting
Muncie	April 10	Plaza Hotel, Newcastle	W. J. Diederichs	Metallurgy of Cast Iron
New Haven	April 17	Burroughs Library, Bridgeport	A. L. Boegehold	Correlation of Recent Data on Hardenability
New Jersey	April 21	Essex House, Newark	Harold G. Williams	Strong Copper Alloys
New York	April 7	Building Trades Bldg.	J. R. Townsend	Materials in Communication
North West	April 8	Covered Wagon, Minneapolis	John M. Hodge	Hardenability Criteria
Northwestern Pennsylvania	Mar. 27	Corry, Pa.		Use of Salt Bath in Heat Treatment
	April 24	Warren, Pa.		(Joint meeting with American Welding Society)
Notre Dame	April 9	Engineering Auditorium, Univ. of Notre Dame	A. J. Phillips	Some Practical Aspects of Certain Theoretical Considerations on the Solidification of Metals and Alloys
Ontario	Mar. 28	Royal York Hotel, Toronto	D. A. Nemser	Effect of Structure on Machining Steel
Oregon	April 3		E. E. Thum	Metallurgical Advances, 1940-1946
Ottawa Valley	April 8	568 Booth St., Ottawa	J. C. Griffin	Die Casting
Philadelphia	Mar. 28	Franklin Institute	Zay Jeffries	Looking Ahead
	April 25	Engineers' Club	P. Payson	A Modern Viewpoint on the Annealing of Steel
Pittsburgh	April 17	Mellon Institute		Young Fellows' Night
Rhode Island	April 2			Modern Trends in High Production Machining of Metals
Rochester	April 14	Powers Hotel	B. F. Shepherd	Martempering
Rocky Mountain	April 18	Hotel Oxford, Denver	F. G. Tatnall	Combining Engineering and Metallurgy
Pueblo Group	April 17	Hotel Whitman, Pueblo	F. G. Tatnall	Combining Engineering and Metallurgy
Saginaw Valley	April 15	Fischer's Hotel, Frankenmuth, Mich.	Mr. Kirkpatrick	Atomic Bomb
Southern Tier	April 14	Hotel Frederick, Endicott, N. Y.	H. B. Osborn	Induction Heating
St. Louis	April 17		John Reese	Copper and Its Alloys
	April 26	Rolla, Mo.		Joint Meeting with Missouri School of Mines Chapter
Springfield	April 21	Weldon Hotel, Greenfield, Mass.	A. H. Koch	Industrial Furnace Atmospheres
Syracuse	April 1	Onondaga Hotel	S. L. Hoyt	Metallography and Physical Testing
Terre Haute	April 14	Indiana State Student Union Building	E. Dale Trout	X-Ray and Its Use in Industry
Texas	April 22	Houston Country Club	M. W. Dalrymple	Metallography
Toledo Group	April 23			Metallurgy in the Stamping Industry
Tri-City	April 7			Party Night
Tulsa	April 8		G. E. Brumbach	Toolsteels
Washington	April 14	Garden House, Dodge Hotel	R. H. Harrington	Nonferrous Metallurgy
West Michigan	April 21			Grinding
West. Ontario	April 25	Hotel London	R. C. Stewart	Heat Treatment of Metal
Worcester	April 9	King's Corner Restaurant, No. Leominster	W. H. Kemper	Selection, Heat Treatment and Handling of Plastic Mold Steels
York	April 9	Harrisburg	A. M. Montgomery	Precipitation Hardening

transferring engineering drawings directly to the material to be fabricated to eliminate templets, for reproducing drawings to various scales, for copying patterns and bend blocks directly from drawings, for projecting drawings to a shrink scale for pattern and diemaking, and for making a full drawing of a symmetrical part from a half figure.

24-42. Residual Stresses in Aluminum Alloys. (Concluded.) R. M. Brick. *Aluminum and Magnesium,* v. 3, Jan. 1947, p. 6-7, 24.
Origin of residual stresses; residual stresses of mechanical origin; stress relief.

24-43. Getting the Most From a Die Casting Design. H. K. Barton. *Die Castings,* v. 5, Feb. 1947, p. 15-16, 40-41.
Case history which illustrates the service a die caster can provide in adapting a design to this process.

24-44. Design of Die Cast Threads. *Die Castings,* v. 5, Feb. 1947, p. 42-44.
Suggestions as to when threads can be cast.

24-45. Photo-Elastic Models Reveal Weld Stresses. James J. Ryan. *Welding Engineer,* v. 32, Feb. 1947, p. 46-48.
Investigation of the residual weld stresses by the photo-elastic method carried out at the University of Minnesota, using a specially developed bakelite which has the property of expansion with the temperature and the characteristic of becoming relatively weak at temperatures above 230° F. It is possible to determine the location of maximum residual stresses with plug welds and the effects of plate temperatures surrounding the weld. Same method of analysis may easily be extended to linear welds.

24-46. Measuring Stresses Electrically on Power-Driven Machinery. W. R. Mehaffey. *Electrical Manufacturing,* v. 39, Feb. 1947, p. 91-95, 156, 158, 160, 162.
Use of electric resistance strain gages in design of equipment.

24-47. Metallography, Fatigue of Metals and Conventional Stress Analysis. H. F. Moore. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 2,* Dec. 1946, 16 p.
History of stress analysis in pre-metallographic days, including the work of Hooke and the development of elastic theory. Influence of stress concentration and the sensitivity of materials to notches, and some of the ways in which such effects can be minimized. Limitations of stress analysis.

24-48. Fatigue Problems Associated With Aircraft Materials. H. Sutton. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 4,* Dec. 1946, 15 p.
Fatigue properties of materials under simple conditions of loading as employed in laboratory tests with special reference to light alloys and to different conditions of stressing. Effect of surface finishes on fatigue properties. Influence of loads occurring in service in the light of available data and research results. Importance of good design for avoidance of fatigue failure; methods of improving fatigue resistance, with special reference to nitriding of steels, shot-peening, anti-fretting treatments, surface rolling, stress-relieving grooves, and stress-relieving heat treatments.

24-49. The Factors Contributing to Fatigue Failure in Aircraft. C. W. George, S. F. Grover and B. Chalmers. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 5,* Dec. 1946, 6 p.
Results of examination of fatigue failures of metallic components in aircraft and various factors that contribute to the formation of fatigue cracks. The usual method of expressing the results of laboratory fatigue tests affords insufficient data for aircraft designers; suggestions for obtaining more accurate information for design purposes.

24-50. Repeated Loading on Structures. A. G. Pugsley. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 6,* Dec. 1946, 6 p.
Considerations of loads which are repeated at intervals ranging from seconds to hours and at rates which can be regarded as gradual compared with the natural periods of the structures concerned. It is important to carry repeated load tests to ultimate collapse since initial failure may not give a true indication of the mode of ultimate failure.

24-51. Structures Liable to Fatigue Failure and Some Considerations in Their Design. L. R. Jackson and H. J. Grover. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 7,* Dec. 1946, 9 p.
Results of experimental work recently carried out in the United States and a number of the more important considerations such as stress distribution under repeated loads, types of repeated stress, stress concentration, size effect and surface conditions.

24-52. The Measurement of Dynamic Strain. F. W. Hooton. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 10,* Dec. 1946, 22 p.
Requirements of devices for measuring dynamic strains and the general principles of operation of various types of electrical and mechanical gages. Electrical resistance strain gage and its associated equipment, fields of application and the limitations of particular circuits which have been successfully used. Additional complications introduced when strains are to be measured on rotating members.

24-53. Determination of Stress Concentration Factors. F. S. Shaw. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 12,* Dec. 1946, 31 p.
Better known methods of determining stress concentration factors. Relative merits of the methods and the use of stress concentration factors in design. An appendix summarizes the stress concentration factors for a variety of different stress raisers.

24-54. Photo-Elasticity and Stress Concentration. W. H. H. Gibson. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 13,* Dec. 1946, 13 p.
The technique of photo-elasticity as applied to problems of stress concentration. Cutting tools and methods used in the preparation of models, together with edge effects and annealing of the photo-elastic material. Thickness ratio as a means of estimating the limiting radius for a notch, groove, or similar stress raiser, below which results are likely to become unreliable. Stress determination at loaded boundaries and internal points, with particular reference to the Coker lateral extensometer. Frozen-stress technique.

24-55. Residual Stresses, Their Measurement and Their Effects on Structural Parts. George Sachs. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 15,* Dec. 1946, 11 p.
Method for measuring residual stresses developed by the author in 1927 and its limitations and applications. Mathematical details of the method. Relations between the residual stresses and the strength properties.

24-56. The Design of Cylindrical Shaft Subjected to Fluctuating Loading. G. G. McDonald. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 16,* Dec. 1946, 8 p.
"Maximum elastic distortional energy" theory of failure is applied to a cylindrical shaft subjected to combined fluctuating bending, twisting and direct loads. An expression is derived for the particular case of combined fluctuating, bending and twisting moments. Experimental results on combined loading of cylindrical specimens confirm the formula.

24-57. The Use of Electric Gaging Equipment in Machine Design. P. E. Nokes and E. G. Carr. *Mechanical Engineering,* v. 69, Feb. 1947, p. 117-119.
Basic apparatus; several specific arrangements show the design engineer how this equipment can be of value to him.

24-58. Are You Designing Correctly? G. E. Campbell. *Industry and Welding,* v. 20, Feb. 1947, p. 30-32, 80-82.
How to calculate shrinkage, select subassemblies, prepare joints, and determine type and size of welds.

24-59. Wire Dimensions for Screw Threads. John Wesley Lee. *Tool Engineer,* v. 18, Feb. 1947, p. 36-38.
Effect that the thread helix angle has on the shape and size of the thread at a normal section, and how it affects the calculation of authentic wire dimension.

24-60. Light Metals Dominate French Automotive Design. *Product Engineering,* v. 18, Feb. 1947, p. 81-87.
Automobile design in France is governed by three major considerations; adoption of lightweight alloys of aluminum, and in a few instances magnesium; development of the one-piece body chassis utilizing the stressed skin principle; and wide-spread use of the flat twin-cylinder air-cooled engine.

24-61. Designs for Sheet Metal Boxes With Square and Round Corners. Part I. *Product Engineering,* v. 18, Feb. 1947, p. 122-123.
Designs for seamed, welded, and folded constructions. Blank sizes and methods of manufacture.

24-62. Models: Short Cut to Good Design. *Modern Industry,* v. 13, Feb. 15, 1947, p. 44-47.
How astute designers and manufacturers are using models.

24-63. Photogrid Process Applied to Problems in Machine Design. G. A. Brewer. *Machine Design,* v. 19, Feb. 1947, p. 120-122.
Use of this process for determination of plastic strains over almost any size gage length, or strains encountered during forming operations.

24-64. Highlights From Machine Design Group Meeting. *Machine Design,* v. 19, Feb. 1947, p. 123-128.
Abstracts of following papers presented at two 1946 meetings of Machine Design group of A.S.M.E. Stress and Strength of Machine Parts by Charles Lipson; Design of Large Broaching Machines by George R. Squibb; Electronic Measurement in Design by P. E. Nokes and E. G. Carr; Kinematics of Cam and Follower by Allan H. Candee; Ball Bearing Ratings by Thomas Barish.

24-65. Bending Stiffness of Beams With Ribs or Slots. R. L. Benford. *Machine Design,* v. 19, Feb. 1947, p. 157-158.
An exact method, developed for circular sections but applicable to other symmetrical profiles. Formulas are given for calculating the bending stiffness corrections for one or more ribs or slots on a round section.

24-66. Rubber Mountings Minimize Impact From Jolt Molding Machines. H. J. Knell. *Iron Age,* v. 159, Feb. 20, 1947, p. 54-56.
Use of rubber mountings to minimize the vibration of surrounding areas caused by operation of jolt molding machines.

For additional annotations indexed in other sections, see:
3-51; **9**-17-23-27-28; **12**-33; **19**-44-53-57; **20**-92; **22**-69-71-100; **23**-33; **27**-34-49.

NATIONAL MEETINGS *for April*

April 7-10—National Association of Corrosion Engineers. Annual Convention, Palmer House, Chicago. (Elton Sterrett, executive secretary, N.A.C.E., 905 Southern Standard Building, Houston 2, Texas.)

April 8-11 — American Management Association. Packaging Exposition, Convention Hall, Philadelphia. (Clapp and Poliak, Inc., 350 Fifth Ave., New York 1, N. Y.)

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POSITIONS OPEN

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SALESMAN: Exp. toolsteel salesman to sell Bethlehem toolsteels for Philadelphia distributor. Apply by letter giving complete history. Replies kept confidential. Hill-Chase & Co., Inc., Trenton Ave. & Ontario St., Philadelphia 34, Pa.

SUPERINTENDENT, ASSISTANT: Large commercial heat treating plant. Basic met. knowledge, broad experience and outstanding capacity to plan and get out volume and variety of work. Unrestricted opportunity and advancement for competent man. Profit sharing plan. State training, exp. and present salary. Box 3-5.

SALESMAN: Wanted by important manufacturer of tubing, both seamless and welded, carbon, alloy and stainless steel. Must have mech. or met. eng. college degree, or suitable alloy steel field sales exp. Give full particulars with application. Box 3-10.

SALES ENGINEER: With knowledge of thermostatic bimetals, electrical contact points and rolled gold plate, to call on users of these products in New York and surrounding states. State education, experience and salary requirement. Box 3-135.

ENGINEER: Excellent opportunity for man with background in fabrication of bimetals and contact points in new division of established company. Give age, training and experience. Box 3-140.

Midwest

METALLURGIST: For ferrous research. Background in wrought or cast physical met. Research exp. desired but not necessary. Opportunities for advancement are limited only by capabilities of successful applicant. All replies promptly acknowledged and held in confidence. Write directly to Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.

METALLURGIST: 3 to 5 yr. industrial exp. in metallography, heat treatment and physical testing of standard engineering steels. Knowledge and exp. in layout and installation of heat treating equipment, inspection and quality control, met. investigation of service failures and actual steel mill operations also desirable. Box 3-15.

METALLURGIST: With qualifications and interest in physical met. Candidate for advanced degree. Lucrative research fellowship in alloy steels with full access to fine university facilities. Box 3-20.

Southeast

SALES REPRESENTATIVE: For prominent producer of stainless steels, heat resisting alloy castings and rolled stainless steel products. Either individual or sales engineering agency with established contacts in met., textile, vitreous enameling and chemical processing industries in Ala., Ga., S.C. and Fla. Products include rough and finished castings and fabricated products for which there is a large demand in this territory. Box 3-25.

POSITIONS WANTED

TOOL AND DIE HARDENER: 13 yr. exp. heat treating all grades of carbon and high speed toolsteels. Capable of taking charge of dept. West Coast location preferred. Box 3-30.

METALLURGIST: B.S. in met. Age 33. Excellent production and met. background in mfg., fabrication and heat treatment of steel. Desires position with mfg. plant in eastern Pa. Box 3-35.

STAINLESS STEEL METALLURGIST: Desires responsible connection with progressive firm. Age 36, married, grad. metallurgist. 9 yr. exp. with all phases of the manufacture and fabrication of stainless bar, wire and sheet material, 2 yr. with carbon and alloy steels, 2 yr. with brass and bronze alloys. Box 3-40.

METALLURGICAL ENGINEER: B.S. in met. eng. Age 26, married. 5 yr. exp. in war and automotive plant, in lab. and production control. X-ray, spectrochemical analysis, materials testing, aluminum foundry and forging plant trouble shooting, and heat treating. Desires responsible position in aggressive Midwest plant. Box 3-45.

ENGINEER: Desires position with a company operating several plants. Interested in being technical assistant to president. Over 25 yr. exp. in plant design and operation; has developed many successful ideas in production machinery and methods. Held important post in the production development of the aviation engine industry during the war. Box 3-50.

FERROUS METALLURGIST: 19 yr. exp. in plain carbon, alloy and stainless steels, seamless tubing, sheet, strip and structural. Particularly interested in sales or sales service work in the above products but will consider met. position. Box 3-55.

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HEAT TREATER: 10 yr. exp. in all phases of heat treating and trouble shooting in ferrous metallurgy. Also some nonferrous and stainless steel exp. 3 yr. college met., and openhearth and mill exp. Desires position with progressive co. Willing to travel. Box 3-65.

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METALLURGIST AND AUTOMOTIVE ENGINEER: 7 yr. exp. in automotive met. and eng. with extensive experience in production heat treatment, induction hardening, eng. specification and project work. Desires position in sales eng. and met. Age 30. Living in Mich., but will relocate. Box 3-85.

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METAL FINISHING ENGINEER: Grad. chem. engr. 5 yr. broad exp. in metal finishing (both organic and electroplating), surface preparation, infrared baking, etc. Both theoretical and practical. Will consider position in either mfg. or sales. Prefers West Coast, but would consider locating in any large city. Employed at present. Box 3-100.

METALLURGIST: Age 30, college grad. Exp. in lab. supervision, specifications, heat treating and production processing, principally with ferrous metals. Desires responsible position in steel fabrication but will consider other phases of metallurgy. Free to move. Box 3-105.

FERROUS METALLURGIST: Over 20 yr. exp. in physical testing, chemical analyses, micrographic work, heat treating, operation of cupola, electric furnace, etc. 4 yr. met. sales. Box 3-110.

METALLURGIST: 23 yr. varied chem. and met., ferrous and nonferrous exp. in consulting and research control. Expert on new alloy development, selection of eng. materials, all metal processing operations. Can plan, organize, direct research or control depts. Now directing small research dept. Interested in responsible position needing broad exp. with progressive co. Box 3-115.

METALLURGIST: 7 yr. in aircraft plant. Exp. includes research development, heat treatment, material selection, process control and failure investigation in connection with aircraft parts. Desires position in southern New England. Box 3-120.

SALES ENGINEER: Grad. met. eng. with 10 yr. of ferrous and nonferrous exp. Plant, lab. eng. staff and college teaching. Excellent speaker, good personality. Desires position as sales engineer with progressive co. Location immaterial. Box 3-125.

ENGINEER: College grad. Exp. in machinery engineering, development, design and research. Inventions and technical articles on machine tools. Prefers Midwest location. Box 3-130.

CHIEF ENGINEER (mechanical, metallurgical): Executive; tech. grad.; registered prof. engr. 30 yr. exp.; outstanding reputation. Major experience in forging field; design, processing, research, production, advertising, sales. Available immediately. Box 3-145.

transferring engineering drawings directly to the material to be fabricated to eliminate templets, for reproducing drawings to various scales, for copying patterns and bend blocks directly from drawings, for projecting drawings to a shrink scale for pattern and diemaking, and for making a full drawing of a symmetrical part from a half figure.

24-42. Residual Stresses in Aluminum Alloys. (Concluded.) R. M. Brick. *Aluminum and Magnesium*, v. 3, Jan. 1947, p. 6-7, 24.

Origin of residual stresses; residual stresses of mechanical origin; stress relief.

24-43. Getting the Most From a Die Casting Design. H. K. Barton. *Die Castings*, v. 5, Feb. 1947, p. 15-16, 40-41.

Case history which illustrates the service a die caster can provide in adapting a design to this process.

24-44. Design of Die Cast Threads. *Die Castings*, v. 5, Feb. 1947, p. 42-44.

Suggestions as to when threads can be cast.

24-45. Photo-Elastic Models Reveal Weld Stresses. James J. Ryan. *Welding Engineer*, v. 32, Feb. 1947, p. 46-48.

Investigation of the residual weld stresses by the photo-elastic method carried out at the University of Minnesota, using a specially developed bakelite which has the property of expansion with the temperature and the characteristic of becoming relatively weak at temperatures above 230° F. It is possible to determine the location of maximum residual stresses with plug welds and the effects of plate temperatures surrounding the weld. Same method of analysis may easily be extended to linear welds.

24-46. Measuring Stresses Electrically on Power-Driven Machinery. W. R. Mehaffey. *Electrical Manufacturing*, v. 39, Feb. 1947, p. 91-95, 156, 158, 160, 162.

Use of electric resistance strain gages in design of equipment.

24-47. Metallography, Fatigue of Metals and Conventional Stress Analysis. H. F. Moore. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 2*, Dec. 1946, 16 p.

History of stress analysis in premetallographic days, including the work of Hooke and the development of elastic theory. Influence of stress concentration and the sensitivity of materials to notches, and some of the ways in which such effects can be minimized. Limitations of stress analysis.

24-48. Fatigue Problems Associated With Aircraft Materials. H. Sutton. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 4*, Dec. 1946, 15 p.

Fatigue properties of materials under simple conditions of loading as employed in laboratory tests with special reference to light alloys and to different conditions of stressing. Effect of surface finishes on fatigue properties. Influence of loads occurring in service in the light of available data and research results. Importance of good design for avoidance of fatigue failure; methods of improving fatigue resistance, with special reference to nitriding of steels, shot-peening, anti-fretting treatments, surface rolling, stress-relieving grooves, and stress-relieving heat treatments.

24-49. The Factors Contributing to Fatigue Failure in Aircraft. C. W. George, S. F. Grover and B. Chalmers. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 5*, Dec. 1946, 6 p.

Results of examination of fatigue failures of metallic components in aircraft and various factors that contribute to the formation of fatigue cracks. The usual method of expressing the results of laboratory fatigue tests affords insufficient data for aircraft designers; suggestions for obtaining more accurate information for design purposes.

24-50. Repeated Loading on Structures. A. G. Pugsley. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 6*, Dec. 1946, 6 p.

Considerations of loads which are repeated at intervals ranging from seconds to hours and at rates which can be regarded as gradual compared with the natural periods of the structures concerned. It is important to carry repeated load tests to ultimate collapse since initial failure may not give a true indication of the mode of ultimate failure.

24-51. Structures Liable to Fatigue Failure and Some Considerations in Their Design. L. R. Jackson and H. J. Grover. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 7*, Dec. 1946, 9 p.

Results of experimental work recently carried out in the United States and a number of the more important considerations such as stress distribution under repeated loads, types of repeated stress, stress concentration, size effect and surface conditions.

24-52. The Measurement of Dynamic Strain. F. W. Hooton. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 10*, Dec. 1946, 22 p.

Requirements of devices for measuring dynamic strains and the general principles of operation of various types of electrical and mechanical gages. Electrical resistance strain gage and its associated equipment, fields of application and the limitations of particular circuits which have been successfully used. Additional complications introduced when strains are to be measured on rotating members.

24-53. Determination of Stress Concentration Factors. F. S. Shaw. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 12*, Dec. 1946, 31 p.

Better known methods of determining stress concentration factors. Relative merits of the methods and the use of stress concentration factors in design. An appendix summarizes the stress concentration factors for a variety of different stress raisers.

24-54. Photo-Elasticity and Stress Concentration. W. H. H. Gibson. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 13*, Dec. 1946, 13 p.

The technique of photo-elasticity as applied to problems of stress concentration. Cutting tools and methods used in the preparation of models, together with edge effects and annealing of the photo-elastic material. Thickness ratio as a means of estimating the limiting radius for a notch, groove, or similar stress raiser, below which results are likely to become unreliable. Stress determination at loaded boundaries and internal points, with particular reference to the Coker lateral extensometer. Frozen-stress technique.

24-55. Residual Stresses, Their Measurement and Their Effects on Structural Parts. George Sachs. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 15*, Dec. 1946, 11 p.

Method for measuring residual stresses developed by the author in 1927 and its limitations and applications. Mathematical details of the method. Relations between the residual stresses and the strength properties.

24-56. The Design of Cylindrical Shaft Subjected to Fluctuating Loading. G. G. McDonald. *Symposium on the Failure of Metals by Fatigue, University of Melbourne Preprint 16*, Dec. 1946, 8 p.

"Maximum elastic distortional energy" theory of failure is applied to a cylindrical shaft subjected to combined fluctuating bending, twisting and direct loads. An expression is derived for the particular case of combined fluctuating, bending and twisting moments. Experimental results on combined loading of cylindrical specimens confirm the formula.

24-57. The Use of Electric Gaging Equipment in Machine Design. P. E. Nokes and E. G. Carr. *Mechanical Engineering*, v. 69, Feb. 1947, p. 117-119.

Basic apparatus; several specific arrangements show the design engineer how this equipment can be of value to him.

24-58. Are You Designing Correctly? G. E. Campbell. *Industry and Welding*, v. 20, Feb. 1947, p. 30-32, 80-82.

How to calculate shrinkage, select subassemblies, prepare joints, and determine type and size of welds.

24-59. Wire Dimensions for Screw Threads. John Wesley Lee. *Tool Engineer*, v. 18, Feb. 1947, p. 36-38.

Effect that the thread helix angle has on the shape and size of the thread at a normal section, and how it affects the calculation of authentic wire dimension.

24-60. Light Metals Dominate French Automotive Design. *Product Engineering*, v. 18, Feb. 1947, p. 81-87.

Automobile design in France is governed by three major considerations; adoption of lightweight alloys of aluminum, and in a few instances magnesium; development of the one-piece body chassis utilizing the stressed skin principle; and widespread use of the flat twin-cylinder air-cooled engine.

24-61. Designs for Sheet Metal Boxes With Square and Round Corners. Part I. *Product Engineering*, v. 18, Feb. 1947, p. 122-123.

Designs for seamed, welded, and folded constructions. Blank sizes and methods of manufacture.

24-62. Models: Short Cut to Good Design. *Modern Industry*, v. 13, Feb. 15, 1947, p. 44-47.

How astute designers and manufacturers are using models.

24-63. Photogrid Process Applied to Problems in Machine Design. G. A. Brewer. *Machine Design*, v. 19, Feb. 1947, p. 120-122.

Use of this process for determination of plastic strains over almost any size gage length, or strains encountered during forming operations.

24-64. Highlights From Machine Design Group Meeting. *Machine Design*, v. 19, Feb. 1947, p. 123-128.

Abstracts of following papers presented at two 1946 meetings of Machine Design group of A.S.M.E. Stress and Strength of Machine Parts by Charles Lipson; Design of Large Broaching Machines by George R. Squibb; Electronic Measurement in Design by P. E. Nokes and E. G. Carr; Kinematics of Cam and Follower by Allan H. Candee; Ball Bearing Ratings by Thomas Barish.

24-65. Bending Stiffness of Beams With Ribs or Slots. R. L. Benford. *Machine Design*, v. 19, Feb. 1947, p. 157-158.

An exact method, developed for circular sections but applicable to other symmetrical profiles. Formulas are given for calculating the bending stiffness corrections for one or more ribs or slots on a round section.

24-66. Rubber Mountings Minimize Impact From Jolt Molding Machines. H. J. Knell. *Iron Age*, v. 159, Feb. 20, 1947, p. 54-56.

Use of rubber mountings to minimize the vibration of surrounding areas caused by operation of jolt molding machines.

For additional annotations indexed in other sections, see:
3-51; 9-17-23-27-28; 12-33; 19-44-53-57; 20-92; 22-69-71-100; 23-33; 27-34-49.

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25 MISCELLANEOUS

25-13. Some Aspects in the Development of Alloy Steels. L. Rotherham. *Metallurgia*, v. 35, Dec. 1946, p. 75-77.
Directions in which alloy steels have been developed during and since the war, including alloy conservation, heat treatment improvements, welding, machinability, newer high temperature alloys, new casting methods.

25-14. Copper and Copper Alloys. E. Voce. *Metallurgia*, v. 35, Dec. 1946, p. 78-84.
Technical progress during 1946. Production of copper and its up-grading by distillation; the casting and properties of a number of copper alloys; corrosion and oxidation and some aspects of physical metallurgy. 50 ref.

25-15. Magnesium and Its Alloys. F. A. Fox. *Metallurgia*, v. 35, Dec. 1946, p. 85-91.
Recent technical progress in extraction and production, fabricating processes, engineering processes, protection, research on alloys, structure, corrosion, design and applications. 52 ref.

25-16. Lead and Its Alloys. Brian M. Reavell. *Chemical Age*, v. 56, Jan. 4, 1947, p. 21-25.
History, mining, refining, problems of purification, commonly used alloys, chemical properties, applications, methods of casting.

25-17. Canadian Research on Magnesium Alloys. J. W. Meier. *Modern Metals*, v. 2, Jan. 1947, p. 20-24.
The facilities available for research on magnesium and some of the work already completed or under way.

25-18. Annual Engineering Review. *Materials & Methods*, v. 25, Jan. 1947, p. 87-110.
Developments in selection of engineering materials and methods of processing them. Carbon and low-alloy engineering steels; stainless steels, tool-steels, heat resistant alloys; cast irons and steels; aluminum and magnesium alloys; copper and its alloys; other nonferrous metals; parts and metal-forms; plastics; woods, rubbers, glass, other nonmetallics; melting and casting; rolling, wiredrawing, extruding; powder metallurgy; forging; stamping, drawing and pressworking; machining; welding, joining, fastening, cutting; heating and heat treating; cleaning and pickling; finishing and coatings; coatings; testing and inspection; instrumentation and control.

25-19. Steel. *Russian Technical Research News*, v. 1, no. 5, 1947, p. 4.
Outlines four recent papers: Analysis of forces involved in cold rolling. Use of centrifuge to corroborate results of X-ray analysis of eutectic alloys. Atomic structure of scale on steel. Hairline cracks in steel.

25-20. Plant Freezer. *Steel*, v. 120, Feb. 10, 1947, p. 98-99, 108.
With dry ice roller bearings can be shrunk onto huge eccentric shafts easily and in short time. Procedure.

25-21. Turntables Aid Assembly-Line Testing. Ben C. Brosheer. *American Machinist*, v. 91, Feb. 13, 1947, p. 129-132.
How Hotpoint dishwashers are quickly moved by conveyer turntables to test stands, avoiding inspection tie-ups on final assembly line.

25-22. Aluminum and Magnesium. John D. Sullivan. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 63-64.
1946 developments in recovery and fabrication.

25-23. Ferrous Physical Metallurgy. R. F. Miller. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 74-77.
Surveys new information published in 1946, which includes much material previously withheld because of wartime security regulations.

25-24. Recent Developments in the Physical Metallurgy of Copper and Copper Alloys and in Equipment and Practice. H. L. Burghoff and W. D. France. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 79-84.
In casting shop trend has been to faster, larger melting furnaces of low-frequency induction type, water-cooled molds and continuous casting. Progress in hot and cold rolling. Research work of Pell-Walpole and other significant studies and researches of 1946.

25-25. Ferro-Alloying Materials. R. M. Briney. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 90.
New type ferro-alloy furnace. Economic position of tungsten, molybdenum, vanadium, boron, manganese and other alloying materials.

25-26. Control of Vibration Can Increase Production Efficiency. John Parina, Jr. *Steel*, v. 120, Feb. 17, 1947, p. 94-96, 98, 118, 121-122, 124.
Various available materials for vibration control and standard methods of their application.

25-27. Efficient Handling Lowers Welding Costs. *Industry and Welding*, v. 20, Feb. 1947, p. 26-29, 58.
Assembly line methods at Reliance Electric Co.

25-28. The Platinum Metals Industry in Germany. E. C. Rhodes, C. H. Jahn and A. G. Dowson. *British Intelligence Objectives Sub-Committee*, 1945, 53 p.
Significant additions to both fundamental knowledge and processing techniques. Includes high-frequency vacuum melting and casting; production of mirror surfaces by evaporation of metal films onto glass; studies on platinum-gold alloys; beryllium-platinum alloys; quantitative spectrographic analysis of binary platinum alloys; production of refractory crucibles and tubes; and miscellaneous refining, analytical, and production techniques. Appendices contain more complete details on certain processes as provided by German personnel. Some of these are in German.

25-29. 10,000 Trade Names. T. W. Lippert. *Iron Age*, v. 159, Jan. 2, 1947, p. 172-175, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286-286L, 288, 290; Jan. 9, 1947, p. 65-68, 139-142, 145-149; Jan. 16, 1947, p. 64-66, 140, 142-143; Jan. 23, 1947, p. 63-68, 131-134; Jan. 30, 1947, p. 62-66, 149; Feb. 6, 1947, p. 69-72, 154-168; Feb. 13, 1947, p. 66, 136, 138, 140, 142-144, 146, 148, 150, 152-162.
Materials used in the metals and metal-working industries listed in alphabetical form. Tells what the trade name covers, its composition if it is a material, how or where it is used, and full address of the manufacturer or supplier. (To be continued. Reprint of the complete series to be published. Future installments will not be abstracted.)

26 STATISTICS

26-22. Iron and Steel Industry Progress in the Urals. A. N. Speransky. *Metallurgia*, v. 35, Dec. 1947, p. 67-68.
Since the revolution, great progress has been made in developing the iron ore resources of this area. Some of these developments; potentialities of the area.

26-23. Developments in the Iron and Steel Industry During 1946. *Iron and Steel Engineer*, v. 24, Jan. 1947, p. 67-85.
Expansions in facilities and introduction of new plant practices. Includes list of electric motors of over 300 hp. applied to main roll drives in iron and steel and allied industries during 1946, giving characteristics, drive method, kind of mill, purchaser, location and manufacturer.

26-24. The Aluminum Industry in Germany. *Mine & Quarry Engineering*, v. 13, Jan. 1947, p. 23-24.
Light metal industry prohibited in Germany now; importation controlled. Germany led Europe in application of light metals, under government control. Supplies of aluminum. (Reprinted from *British Zone Review*, Nov. 9, 1946.)

26-25. Shasta and California Iron-Ore Deposits—Shasta County, Calif. Part K. Carl A. Lamey. *State of California, Division of Mines Bulletin* 129, Part K, Oct. 1946, 164 p.
Results of survey.

26-26. Chromite Deposits of the Northern Coast Ranges of California. Part II. Coast Ranges. D. H. Dow and T. P. Thayer. *State of California, Division of Mines Bulletin* 134, part II, c. I, Dec. 1946, 38 p.
Results of survey.

26-27. Alaska's Minerals as a Basis for Industry. H. Foster Bain. *Bureau of Mines, I. C.* 7379, Dec. 1946, 89 p.
An economic survey covering resources of metallic and nonmetallic minerals, coal, and petroleum.

26-28. Platinum Metals Industry Is Returning to Normal Status Under Free Market Conditions. Charles Engelhard. *Metals*, v. 17, Jan. 1947, p. 10.
Speculators forced price to $93.00, followed by recession; sales to consumers averaged 19,775 troy oz. monthly.

26-29. Metal Conservation—a National Problem. C. Gerard Davidson. *Metals*, v. 17, Jan. 1947, p. 11-14.
Country's natural reserves of antimony equivalent to 4 years' supply; lead, 12 years'; cadmium, 16 years'; zinc, 19 years'; copper, 34 years'; platinum, 2 years'; and tungsten, 4 years'.

26-30. The Sheet Metal Outlook for 1947. R. C. Todd. *Finish*, v. 4, Feb. 1947, p. 25, 54, 56.
The current picture and estimates of future supply.

26-31. Mineral Economics. Elmer W. Pehrson. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 50-55.
1946 production and prices of the various metallic and nonmetallic minerals. 1947 trends.

26-32. Mining Geology. Carlton D. Hulin. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 56-58.
New ore discoveries and developments of 1946. We do not have to worry too much about running out of metallic minerals—given favorable government policies.

26-33. Eastern Magnetite. J. R. Linney. *Mining and Metallurgy*, v. 28, Feb. 1947, p. 73.
Production statistics from the various mines.

26-34. British Planning Reorganization of German Steel Industry. Jack R. Hight. *Iron Age*, v. 159, Feb. 20, 1947, p. 106-109.
Program includes socialized industry and liquidation of old steel combine.

26-35. Metals Survey and Forecast. *Engineering and Mining Journal*, v. 148, Feb. 1947, p. 70-91.
Present status and future prospects from the economic point of view of the different nonferrous metals, including the minor metals, such as beryllium, cobalt, etc. A chart and tables show metal prices since 1897.

For additional annotations indexed in other sections, see: 25-25.

27 NEW BOOKS

27-31. Concise Chemical and Technical Dictionary. Edited by H. Bennett. 1120

(Turn to page 52)

Foley Speaks on High-Temperature Alloys

Reported by J. G. Worthington
Metallurgist, J. D. Adams Co.

National Officers' Night was observed by the Indianapolis Chapter on Dec. 9, honoring Francis B. Foley, national vice-president, and superintendent of research, Midvale Co., Philadelphia. His highly interesting talk was on "Steel Alloys for High-Temperature Service". Mr. Foley (left in the photograph) was introduced by Ralph W. Stahl, Lindberg Engineering Co., Chairman of the Indianapolis Chapter (right).

The chapter executive committee, including R. W. Stahl, A. J. Newsom, E. A. Hall, R. H. Stewart, W. E. Ellsworth, J. E. Mitchell, A. H. Barton, P. F. Ulmer, J. W. Watson, J. T. Parker, J. S. Blay, G. Bauer, and J. G. Worthington, was present at a luncheon meeting honoring Mr. Foley

Machining and Machinability

(Continued from page 8)

tions. Influences which lower the shear strength or reduce friction lessen the work required for cutting. The effect of lead in improving machinability is attributed to a lubricating action or to a reduction in strength and ductility of steels at moderately elevated temperatures.

Hardness affects the ease of machining because the shear strength of a steel chip below 900° F. bears a relationship to its tensile strength at room temperature. When all other conditions are equal—which they seldom are—softer materials are easier to cut. Hardness is an unreliable criterion for predicting machinability, however, because ductility and friction are usually higher in softer materials.

Effect of Cold Drawing

Although it raises the strength and hardness, cold drawing is usually believed to improve the machinability of free-cutting steels. There are few, if any, published data from commercial operations to substantiate this opinion. It is difficult to compare hot rolled and cold drawn bars in automatic screw machines because they require closely sized stock. Wagge (20-300, Aug. 1946) is one of the few metallurgists who says that cold drawing impairs machinability. This may not be heresy because it is known that leaded brasses and bronzes become more difficult to machine with increasing amounts of cold work. Crampton (20-134, 1945 volume) gives data from sawing, drilling, and milling tests illustrating this conclusion, and Donaldson (20-233, 1945 volume) is of the same opinion. Free-cutting steels containing elements added to improve machinability have microstructures similar in many respects to these lead-treated, two-phase nonferrous alloys.

While theory is important, most of the improvements in machining operations and in cutting quality of materials have come about as a result of experimentation and of keeping careful records. Considerable doubt exists about the validity of certain assumptions in laboratory tests and the significance of various data. Only a person working in the field realizes, as Crampton says, "how little is actually known about the fundamentals of machinability or even the practical significance of experimental results".

Cleveland Hears President

Reported by W. K. Hansen
Works Chemist
American Steel & Wire Co.

It was National Officers Night for the Cleveland Chapter at the February meeting on Monday, the 3rd. Harry W. McQuaid, consulting metallurgist, acting as technical chairman, introduced National President Alfred L. Boegehold, head of metallurgy department of General Motors Research Laboratories Division. Mr. Boegehold presented a "Correlation of Recent Data on Hardenability".

As the dinner speaker, Spencer Irwin, associate editor and columnist for the Cleveland *Plain Dealer*, discussed "Obstacles to a Stable Peace".

Wanted: Refractories Questions

A feature of the Refractories Section program for the annual American Foundrymen's Convention, to be held in Detroit the week of April 27, will be a question and answer period. The Refractories Committee solicits the active participation of those in attendance at the session scheduled for 4:00 p. m., Tuesday, April 29. Anyone having a question regarding refractories or their use in any branch of foundry work is urged to submit it in advance, addressing the Chairman, Richard H. Stone, % Vesuvius Crucible Co., Pittsburgh 18, Pa.

Memo to Manufacturers - Testing & Inspection Equipment

We have a May issue coming along that YOU could help write - if you will.

This issue will feature testing and inspection operations. It will review equipment and accessories used in physical and mechanical testing - tensile, hardness, fatigue, creep, impact, etc. Also inspection and quality control methods; radiographic inspection and testing.

If you have a new product in this field - or one that has been improved in the past twelve months - send us 250 words of descriptive material, plus a glossy photograph, if available.

Be certain to send this material by April 15.

Thank you!

The Editor
Metals Review

7301 Euclid Avenue, Cleveland 3, Ohio

p., Chemical Publishing Co., Inc., 26 Court Street, Brooklyn 2, N. Y. $10.00.
50,000 definitions of terms used in science and industry. Trade names.

27-32. Bibliography on High-Frequency and Dielectric Induction Heating. 97 p., Aug. 1946. Northwestern Technological Institute Library, Evanston, Ill. 15c.
Classified and arranged alphabetically according to author in each section.

27-33. Protective and Decorative Coatings. Volume V. Joseph J. Mattiello, Editor. 662 p. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $7.00.
The following topics are dealt with in a thoroughgoing manner, each by one or more specialists in the respective fields: analysis of resins, analysis of drying oils, laboratory testing of metal finishes, spectral characteristics of pigments in the visual and infrared regions, and "resinography". Extensively referenced.

27-34. Mathematical Theory of Elasticity. I. S. Sokolnikoff and R. D. Specht. 373 p. McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. $4.50.
The first three chapters contain a comprehensive treatment of the theory of the mechanics of deformable media. Tensor notation is used. However, in the last two chapters, which treat extension, torsion, and flexure of homogeneous beams, and a development of variational methods, the scalar notation is used in discussing specific applications.

27-35. Foundry Process Control Procedures. 145 p. Society of Automotive *Engineers*, 29 West 39th St., New York 18, N. Y.
A compilation of reports made by the S.A.E. War Engineering Board covering steel castings, malleable iron castings, gray iron castings; and castings repair recommendations for steel, malleable iron, and gray iron.

27-36. German Technique in the Production of Light Alloys. P. M. Haenni and T. J. Peake. 22 p. Hobart Publishing Co., Washington, D. C.
Results of an investigation by a Canadian military team. Processes used from the ores to the finished products. Reprinted from PB 20633, Office of Technical Services, U. S. Dept. of Commerce, Washington.

27-37. Manual for Heat Treating Services. Metal Treating Institute, New York. $4.00.
Looseleaf book contains several sections which deal with such subjects as steel selection, machinability, grinding, relationship between heat treatment and design, basic principles of heat treating, a general description of the various heat treatments, nonferrous heat treating and brazing, cold treating, preparation and care of steel surfaces before, during, and after heat treating, inspection and testing, how to order heat treating, and a glossary of metallurgical terms.

27-38. Heat Exchanger Tube Manual. Edition 2. 169 p. Scovill Manufacturing Co., Waterbury, Conn.
Manual has been prepared primarily to serve as a guide in solution of problems involving condenser and heat exchanger tubes. It contains a large amount of information, mostly in tabular and chart form, on tube corrosion, tube installation, fluid flow and heat transfer, and properties of hydrocarbons and petroleum products.

27-39. Melting and Molding of Ferrous and Nonferrous Metals and Alloys. 157 p. U. S. Navy Bureau of Ships, Washington 25, D. C.
Manual is intended for the use of Navy foundry personnel. Describes methods now in use at Navy Yards, at the Naval Research Laboratory, and by industrial foundries for the production of steel, cast iron, bronze, brass, and aluminum alloy castings.

27-40. Mechanical Inspection. H. F. Trewman. 162 p. Sir Isaac Pitman and Sons, Parker St., Kingsway, London, W. C. 2, Eng. 15s.
Essentials of mechanical engineering inspection; 126 illustrations showing practically all types of inspection equipment which would be used in the medium and light engineering industries. 27 tables of limits and dimensions for plain and screw-threaded work, the last chapter being confined to American measuring instruments.

27-41. Magnesium Fabrication. L. B. Harkins. 156 p. Pitman Publishing Co., 2 W. 45th St., New York, N. Y. $2.75.
Techniques of sheet-metal work in magnesium alloys. For light-metal workers and students.

27-42. Atlas of Defects in Castings, Series I, Cp. 34. Institute of British Foundrymen, Manchester, Eng. Associates 5s, nonmembers 10s, members gratis.
Intended to assist ferrous and nonferrous foundrymen in the correct recognition and classification of defects. Series of photographs of typical defects are reproduced with brief notes on the causes of the defects and suggested remedies. (From review in *Iron and Steel*, v. 20, Jan. 1947.)

27-43. Corrosion of Steels. 15 p. United States Steel Export Co., New York, N. Y.
The resistance of common commercial steels to corrosion. Information is general, rather than specific.

27-44. Transactions of the Electrochemical Society. Volume 88, 1946, 448 p. The Electrochemical Society, Inc., Columbia University, New York, N. Y.
32 papers presented at various symposiums during October 1945. Includes papers on electrodeposition of plastics; electro-organic reactions; electric furnace steel production; electrometallurgical processes; manufacture, fabrication, and properties of zirconium; studies of alloys of indium-tin, antimony-tin, and silver-tin; electrodeposition of metals on plastics; bright dipping; cleaning of metal surfaces; and miscellaneous electroplating papers.

27-45. Engineering Radiography. Emmott & Co., Ltd., 31 King St., West, Manchester, Eng. 2s. 6d.
Underlying principles of radiographic inspection of engineering components; requirements and operation of X-ray apparatus. Stresses the need for the cooperation of the metallurgist and other interested parties until such time as the operator has become really expert in diagnosis. (From review in *Foundry Trade Journal*, v. 81, Jan. 2, 1947.)

27-46. Philips Resistance Welding Handbook. 210 p. Philips Industrial (Publications Dept.), Century House, Shaftesbury Ave., London, W. C. 2, Eng. 11s.
Companion volume to Philips Practical Welding Course, which deals with arc welding. Written to help those concerned in the actual carrying out of production jobs. (From review in *Foundry Trade Journal*, v. 81, Jan. 2, 1947.)

27-47. Metallurgical Experiments. F. Johnson. 78 p. Paul Elek, Ltd., Diamond House, 36-38 Hatton Garden, London, E. C. 1, Eng.
Laboratory manual gives directions for over 100 metallurgical experiments.

27-48. Metallic Testing and Heat Treatment. Leofric Fenn. 61 p. Scientific Publishing Co., Manchester, Eng. 5s.
A brief nontechnical description of test equipment and procedures; also heat treating procedures for steel.

27-49. Machine Design. Louis Jacquelin and Paul B. Eaton. Edition 5. 293 p. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $3.25.
New material on the fatigue of metals, modern ideas concerning the nature of friction and lubrication, and special precautions necessary in designing parts made from aluminum.

NEW PRODUCTS IN REVIEW

FORGINGS, HARDENING

Four-page illustrated leaflet describes new installation in a drop forging plant for automatic, continuous hardening, quenching, washing and drawing assorted steel forgings. The installation shows ingenious coordination of materials handling, heating and cooling so as to save space, time, labor and fuel and to assure uniformity of product treatment. Design is based on the idea of synchronizing the movement through all the operations continuously.

W. S. ROCKWELL CO.,
200 Eliot St.,
Fairfield, Conn.

Mention R-370 for Reader Service

MARKING EQUIPMENT

The new automatic No. 52 marking machine, a skillfully engineered machine for fast, accurate marking of flat steel and alloy steel parts, as well as other materials, is featured on the front cover of a new catalog of Acromark stamping, marking and numbering equipment. Although 84 other pieces of equipment are clearly illustrated and described, this brochure, the manufacturer says, is merely an indication of the scope of the line and not a complete all-inclusive showing.

ACROMARK CO.,
9-13 Morrell St.,
Elizabeth, N. J.

Mention R-371 for Reader Service

PRESS, HYDRAULIC

Six-ton capacity air hydraulic press has been added to the present line of 2½-ton capacity models. These presses are used for assembly, riveting, embossing, staking, sizing, crimping and flanging. These presses bring the advantages of hydraulic press operation within the range of users of arbor presses and kick presses. This press is offered in both bench and floor models, and may be plugged into the present air line. The 2½-ton model works on a 50:1 ratio on the air intake pressure; the 6-ton model on a 120:1 ratio. The machine is delivered ready for installation.

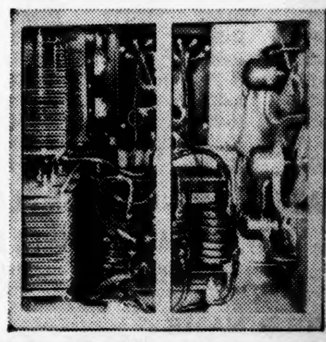
Ram pressure is quickly and easily adjustable and is controlled to predetermined specifications from delicate pressures up to 12,000 lb. The same pressure is delivered throughout the entire length of the stroke, making possible operations that otherwise require greater power. The action is squeeze with speed. Ram speed is adjustable from the slowest action to 300 in. per min.; the stroke is adjustable from 1/2 to 5 in. Presses can be furnished for a predetermined ram dwell or for single cycle or automatic action. Since foot, hand, or solenoid push-button control valves are used, air-hydraulic presses are ideal for women operators. For examples of actual applications, specifications, and price list, write for illustrated eight-page catalog.

AIR-HYDRAULICS, INC.,
401 Broadway,
New York 13, N. Y.

Mention R-372 for Reader Service

RECTIFIER, PLATING

A reliable and economical source of d.c. power, the Wagner-Tiedeman rectifier assembly employs metallic selenium-on-aluminum cells, known for their ability to handle momentary overloads of as much as 1000% normal capacity.



Aluminum back plates in place of steel provide maximum cooling, and essential low-velocity air circulation is provided by three 10-watt fans with a low amperage of only 1.5.

This rectifier reduces power costs while maintaining high efficiency, offer-

MATERIALS INDEX

The following tabulation classifies the articles annotated in the A. S. M. Review of Current Metal Literature according to the metal or alloy concerned. The articles are designated by section and number. The section number appears in bold face type and the number of the article in light face.

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ing an effective rectifying area of over 4300 sq. in. The double-duty transformer is of the two-winding fully insulated type with ample reserve capacity. Occupying floor area of 5½ sq. ft., the rectifier is 34 in. high, 36 in. long, 22 in. wide, and the all-steel welded enclosure is designed so that units may be stacked vertically for higher power.

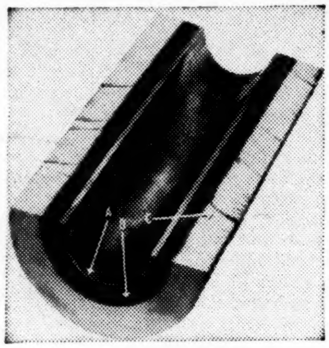
WAGNER BROTHERS, INC.,
421 Midland Ave.,
Detroit 3, Mich.

Mention R-373 for Reader Service

ROLL, STEEL MILL PICKLING

Almost complete resistance to damage from cuts is promised in a new roll for steel-mill pickling lines. This roll utilizes an inner cover of specially developed fibrous material which guards the steel core from contact with acid.

Known as the "Goodyear special hold-down and carrying roll," the new roll continues to utilize a high grade synthetic rubber cover on the weight-carrying surface. This outer cover is unaffected by acids. Until development of this new fibrous material, which is bonded by a special process to the steel core, cuts in the rubber surfaces of pickling tank rolls often permitted acid to reach the core and destroy it. In the illustration, A represents the steel



core, and C test cuts inflicted on the outer rubber surface which failed to pierce the fibrous cover B.

This fibrous material is sufficiently hard to absorb the shock of practically all cuts to which pickling tank rolls are subjected, while remaining immune itself to damage from acid seeping through the gash. The roll's synthetic rubber surface is bonded in turn to the fibrous material. A newly developed bonding process assures tight adhesion to the roll core and cover.

In the pickling process, these rolls are used to carry sheet steel through baths of sulphuric or other acids to remove scale from the steel before further rolling. Regardless of the diameter of the new rolls, the protective fibrous material is applied to each core in a ¼-in. layer. Similarly, the rubber weight-carrying surfaces of the rolls will remain about ¾ in. Since the new-type roll is armored against acid penetration, life of the core is virtually unlimited and full service of the original rubber surface is gained before re-covering is necessary.

GOODYEAR TIRE & RUBBER CO.,
Akron, Ohio.

Mention R-374 for Reader Service

RUST PREVENTIVES

As a result of evaluation of the more than 100 rust preventive formulations developed during the war, Houghton has simplified its rust preventive line and announces a series of nine products to meet all peacetime manufacturing, shipping and storage problems.

Of these corrosion preventives, four are of the removable thin-film solvent type, one is a nonremovable dielectric variety and four are oil-type films varying in viscosity from thin oil film to a medium grease consistency. These nine rust preventives are branded under the Cosmoline series, a name registered by Houghton in 1881 and applied to Houghton products for prevention

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READER SERVICE COUPON

CHECK THESE NUMBERS FOR PRODUCTION INFORMATION AND MANUFACTURERS' CATALOGS

Use this convenient method to obtain further information on items of interest to you in METALS REVIEW. The following numbers refer to the new products and manufacturers' literature in this issue.

Metals Review, March 1947

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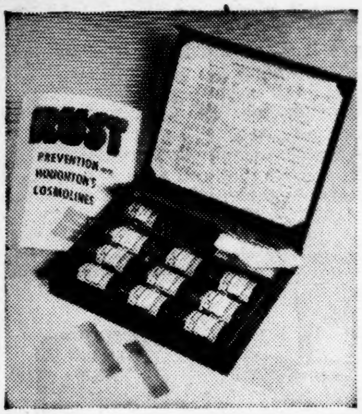
NEW PRODUCTS IN REVIEW



of corrosion since that time. The series of nine products comprising the new line-up include varieties for temporary intraplant protection as well as for shed and outdoor exposure.

E. F. HOUGHTON & CO.,
303 W. Lehigh Ave.,
Philadelphia, Pa.
Mention R-375 for Reader Service

STEEL, STAINLESS CLAD

Manufacture of a complete line of stainless-clad steels has been announced by Lukens Steel. Seventen years ago, Lukens began production of its first clad metal—nickel-clad steel. Other clad steels, Inconel-clad and monel-clad steel, were later developed.

In the Lukens method of manufacturing stainless-clad steels, a light layer of the proper type of solid stainless steel is bonded to a backing plate of carbon or low alloy steel. The process insures uniformity of cladding thickness and a permanent bond between the stainless steel and the backing plate. Stainless steels of types 304, 316, 347, 410 and 430 are the cladding materials generally used. They offer the corrosion resistance and product protection of solid stainless steel, at appreciable savings in material cost over solid stainless. In addition, they have far superior heat conductivity to solid stainless steels and are readily fabricated.

Stainless-clad steels exceed the minimum shear strength requirements of the A.S.M.E. code of 20,000 psi. The A.S.M.E. code permits the cladding to be included in the full thickness for many applications. The cladding is usually 10% of total plate thickness, although any percentage from 5% up to 50% can be obtained. Specifications of both the stainless and the backing plate may be widely varied to meet chemical and physical requirements.

Stainless-clad steels are furnished in plates from $\frac{3}{16}$ to over 3 in. thick, or up to 162 in. wide, and also in heads of all styles and sizes to over 18 ft. in diameter.

LUKENS STEEL CO.,
Coatesville, Pa.
Mention R-376 for Reader Service

STRIP, NICKEL CLAD

Development of rolled nickel and monel-clad strip has been announced by the Superior Steel Corp. This composite strip is available in widths between ¼ in. and 10¼ in., in coils ranging up to several hundred feet depending upon gage. In the cold rolled condition it is produced in thicknesses between 10 and 125 thousandths of an inch. In the hot rolled condition it is available in thicknesses between 95 thousandths and ¼ in.

Depending on requirements, the clad strip is furnished with cladding on one side only or on both sides. The standard cladding thickness is 10% of the total thickness, which means that on the single clad strip the nickel or monel would represent 10% of the total thickness and the steel 90%. On double clad strip the three layers would be 10% nickel or monel, 80% steel, and 10% nickel or monel.

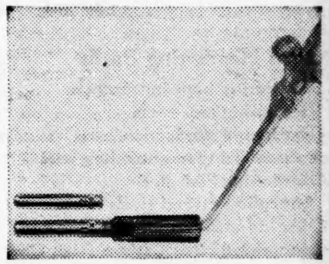
It is impossible to separate the nickel or monel cladding from the steel base by any other means than chemically dissolving out the steel from the cladding. Separation cannot be effected by mechanical means or by heating. Because of this fact, the clad strip can be stamped, drawn, spun, bent, spot welded, or otherwise fabricated in the same manner and with no more difficulty than ordinary low-carbon deep-drawing steel. Because the thermal coefficient of expansion of nickel, monel and steel are nearly the same, there is little danger of warping or twisting in applications where temperature changes are encountered.

Cost of the clad strip is approximately 30 to 35% less than that of solid nickel or monel strip. It is anticipated that this new product will supplement rather than compete with the solid materials. Frequently, combinations of the clad and the solid materials can be used to advantage to provide maximum economy of construction.

SUPERIOR STEEL CORP.,
Carnegie, Pa.
Mention R-377 for Reader Service

TORCH ACCESSORY

Handy new accessory which affords double-duty for all oxy-acetylene welding torches is known as the Cesco Puddler. This new unit fits over the end of any standard welding torch tip. It is used with acetylene alone and pro-



vides an ideal flame for body soldering, tinning, silver soldering and heating jobs. Two tips are furnished with the kit, one for light-duty soldering and one for body soldering.

CESCO PRODUCTS, INC.,
30 N. LaSalle St.,
Chicago 2, Ill.
Mention R-378 for Reader Service

VALVES, CONTROL

"Pneumatic Control Valves and Controller Accessories" is the title of Bulletin 277-1, a 36-page publication. The company's previously familiar valve bulletin has been completely revised and much new material has been added, to give the present bulletin maximum convenience and usefulness.

Among its features are: a color page showing the various identifying enamel finishes offered on Stabilflo valves, corresponding with the color code of the American Standards Association; plates and tables of specifications for control valves, needle-type valves, poppet valves and butterfly valves; separate sections on the Vernier Valvactor for high-accuracy positioning of valve plungers, and on air switches and subpanels for remote valve control. An appendix contains information on computing valve sizes, with tables and formulas.

THE FOXBORO CO.,
Foxboro, Mass.
Mention R-379 for Reader Service

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